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Ham Radio TODAY

Scanner & Ex-PMR Conversions Special

Low Cost Alinco Handheld Reviewed

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Ham Radio TODAY

HAM RADIO TODAY
VOLUME 14 NO.4
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REGULAR COLUMNS

REVIEWS

FEATURES

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NEWS & VIEWS

SMC545L1 & SMC1045L2 ex-PMR conversion (see page 14)

Alinco DJ-190 low cost 2m handheld reviewed (see page 10)

CQ from G8IYA

Editorial

We lose a bit here, we lose a bit there

With this month's issue, you'll no doubt have found something 'extra'. We've teamed up with the RSGB in helping to get beginner's interested in amateur radio, with their bi-monthly *DiY Radio* magazine attached to this issue of Ham Radio Today. *DiY Radio* complements Ham Radio Today by being specifically aimed at the beginner, and Novice, of any age, the issue attached here is also a special double-sized 'bumper issue'. If you're already 'into' amateur radio, maybe you'll pass it onto a friend or youngster who might be interested in amateur radio, or maybe your local school, Scout, or Girl Guides group.

This month's Ham Radio Today software collection also has plenty to interest beginners, as well as experienced amateurs. For example, as well as guides to short wave and scanner listening, there's also a superb CW practice trainer (it's also useful for 'getting your speed up' to 12 or even 20+ WPM), and a fully-featured satellite orbit predictor, to let you know when, for example, the Mir space station is in range so you can give the cosmonauts a call on 2m or 70cm for a QSO.

Next month's Ham Radio Today magazine will have a front cover mounted disk, packed with more superb software - don't miss it!

70cm, going, going....

Anyway, enough of the 'advert', let's get down to some discussion. Most of us agree we need newcomers, and the oft-heard phrase of 'use it or lose it' is getting very relevant in the case of bands such as 70cm (430-440MHz). We've already lost a chunk of the lower end of the band to PMR (Private Mobile Radio) interests around the London area, there's now also talk of loosing the bottom and top ends of the band also to commercial interests. But a bit in the middle is also causing concern around the country. The band of 433.72MHz to 434.12MHz, with a 'centre frequency' of 433.92MHz is available in the UK for licence exempt, low-powered (10mW) car key-fob operation, e.g. for car alarm setting and door-locking operation. Another band, at 418MHz but with a much lower power limit of 250 microtus, is also available for this, and is very widely used for this and applications such as cordless doorbells, security alarms, etc.

Now, it's been reported that over 1,500 433.92MHz data transmitters have been set up along the UK motorway network, in a commercially run traffic reporting system. The idea is you go down to your local high street store and buy a dashboard mounted unit. As you travel around and you pass the data transmitters, you get to know about any traffic problems immediately ahead. Now 433.92MHz is commonly given on a 'non-protected' basis, i.e. the user of equipment on this frequency isn't protected against any disruption or loss of communication due to other signals on the band. Like amateur transmissions. Indeed, I've read of examples where owners could not lock their cars when parking up near UHF transmitters, including amateur repeaters. They probably wouldn't be able to unlock them either - as happened to one unfortunate car transporter driver who found he couldn't unload his cargo.

QRM

From my house, with my chimney-mounted 70cm vertical I can hear virtually constant data on 433.92MHz, spreading several tens of kHz either side of this. So, I can't have a QSO around there. Constant data from transmitters mounted well in the clear is a little different to the occasional 'blip' from a low-powered car key fob. What can we do about it? I'm told that the 'licence exempt' status the company involved are aiming for has non*f*interference at its heart. But, especially with the 50kHz deviation system being used, and reports of out-of-band radiation from a number of these transmitters, is this a *non-interference* system? I'm told that permission from the RA to operate this system depends on how many complaints they receive. Your local RIS office are the people to talk to.

But will we realistically get rid of the problem, unless there's a continual 'out of band radiation' problem? The commercial interests are there, the base stations are installed, the equipment is on sale in the shops. What's next? Maybe we'll be told that we can't use that frequency range, plus a 'guard band' either side of it, any more. We can't usefully use it in many areas in any case, so what's the problem, you may say? In discussions between my Tech Ed and the RA, the RA told him that only "vehicle radio keys" are allowed on this frequency range in the UK. Maybe they're just running under a 'test and development licence'. The range is, however, a harmonised pan-European band, and in some other European countries, two-way speech communication is also allowed here, using type-approved transceivers. In other words, anyone can use 70cm for chatting away over short distances. A variant of the small Standard C408 'credit card' sized 70cm transceiver, (reviewed in the April '94 issue), is widely on sale in Germany for this very purpose. Of course, these commercial chaps could suffer interference from radio amateurs (and of course from each other, although amateurs are allowed to run far higher power levels).

Data transmissions giving arguably essential road traffic data, and commercial business communication, could be seen to need 'protecting' from interference by other high power transmissions in the band. Remember, in the UK it's the military, and not amateurs, who are the prime users. Which is why one MoD airfield quite legitimately used FM handhelds on 433.500MHz (our 70cm FM simplex calling frequency, SU20), although they did wonder what these guys calling 'CQ' were doing!

But I wonder if we'll be losing another 'chunk' around 434MHz to a possible new 'primary user' on 70cm?

Alinco DJ-190 Handheld Review

G4HCL tests an easy-to-use 2m handheld rig

You find many 2m handhelds nowadays, all equipped with multi-function knobs and buttons. Some even come with a carry-around instruction card to help you use them! But even though I'm a self-confessed 'gadget freak' the DJ-190 was a refreshing change. A *very* refreshing change. Yes, it's got all the memory channels you'd need, 40 of them in fact, together with CTCSS (sub-tone) encode and 1750Hz toneburst for repeater access, memory channel scanning, scan skip, and so on. But it's still reasonably *easy* to use. At just under the £200 pound mark, it's also fairly reasonably priced!

What you get

For your cash you get a smart and nicely slim 2m handheld, which gives you 1.5W out on transmit from the supplied 4.8V 700mAh nicad pack. You also get a desktop overnight nicad charger, set-top helical, and a belt clip and wrist strap. There's also a 25 page instruction book, plus a full circuit diagram in case you feel like 'delving inside' (have a magnifying glass handy!).

Plugging in an external 12V DC supply, such as a DC lead from your car's cigar lighter socket, or substituting an optional 9.6V nicad pack, gives you 5W output, (or 3.5W with a 7.2V pack), with a switchable low power setting in each case.

Controls

You'll see from the accompanying photos that the rig's controls have been kept to an absolute minimum. In fact, the set-top rotary knob (for channel change) and up/down buttons (for volume adjustment) were the only controls I needed for normal everyday use over the review period.

The front panel display clearly shows the operating frequency, in *large* digits, together with other information such as memory channel, a six-level S meter and relative TX power bar-graph (or rather, 'star' graph) indication, plus smaller icons

for repeater shift, low battery warning, CTCSS and so on. The display can also be changed to instead indicate just the memory channel number in large digits, which I found very useful. More of this later.

The way the controls have been kept simple has, as is now becoming usual, been accomplished through a 'menu' system for setting the lesser-used operating modes. For this, a function button is located on the PTT bar section, which accesses plenty of other features. Like repeater shift and direction, memory channel programming, CTCSS tone frequency and setting, transmit time-out timer, automatic power off function, and receiver squelch level. Don't worry, there's also a handy 'moni' button on the PTT section, which you can use to lift the set's squelch for that odd weak signal you want to listen hard for. A further small button above this switches on an LCD backlight for a few seconds so at night you can see what the set's doing, this button also serves to select high/low transmit power.

The set-top BNC aerial socket lets you plug in an external aerial, for use at home for example, although the manual does sensibly warn of the possibility of intermodulation from other signals. Further sockets for an external mic and speaker/earphone are also provided, plus a side-mounted external DC socket.

The DJ-190, with the supplied nicad, measures 57mm (W) x 151mm (H) x 27mm (D) and weighs 300g.

On the air

After charging the nicad, it didn't take me long to get the set up an running, and listening to a local QSO on S22. Just a few seconds in fact. But after the contact had ended, I found that I *did* have to read the book, to find how to set the squelch level to shut the set up!. Once done, however, I rarely needed to change it again. Likewise with the repeater shift - changing between simplex and repeater in 'VFO' mode was rather a pain, with multiple button pushes and knob/switch settings. But here, after programming the 2m repeater channels of R0-R7 into appropriate memory channels, I didn't have to select or change this again.

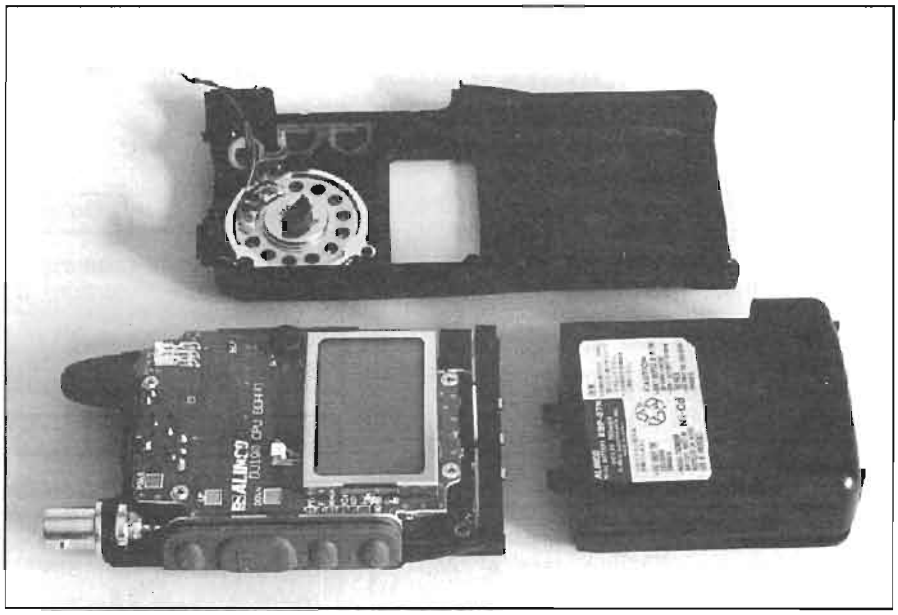
After a period of use I found I was normally, and only, using the memory channels, which by then I'd also programmed up with simplex channels S8-S23 and a few of my locally-used natter channels at the bottom of the band. I found it a little annoying however that, when manually scanning through the memory channels, the unprogrammed channels were not skipped. For example, if you've nothing stored in, say, channels 23 to 34, you still have to cycle through these to reach channel 35 if you've programmed something in that channel. However, the set defaulted to VFO mode on the non-programmed channels, which I sometimes felt was quite handy. Placing the set in 'channel readout only' mode overcame this, with it just

changing between programmed channels, this mode probably having been steered by possible commercial uses for the set.

With the set's slim case I found it easy to hold and use, it also slipped into my top pocket nicely. There was ample undistorted receiver audio from the set's internal speaker for use when out and about, even for use when mobile while I was using the set in the car. I found here that I could easily control the set by 'feel alone' without the need to glance down at the set, to make using the set whilst driving rather safer than otherwise.

The operating feature I would have liked however was a quick 'reverse repeater' (i.e. 'listen on input') monitor function. The monitor button raised the squelch but unusually didn't switch to the repeater input, nor could it be programmed to do, unlike virtually every other current rig I've used. So instead, I just programmed up an extra few memory channels with these.

On transmit, my audio was described as slightly bassy but otherwise fairly good. Even though the receiver was quite sensitive, I found the supplied short helical to be rather less efficient than others. Due to this I had problems on transmit in getting into my two semi-local 2m repeaters when portable, although living in such a 'fringe area' provides a useful review test. Substituting a commercial VHF helical, albeit a couple of centimetres longer, gave an improvement of several dB.



At home, with my rooftop colinear connected, I found the receiver very sensitive indeed, although (to be expected) I did get the occasional problem from signals in the 146MHz band from my local fire brigade station and other out-of-band signals. Right now, I'm listening to a very strong local amateur on S21, *and* rather weakly on S23, and S21, *and* S19, and R1 output.... due to the DJ-190's receiver intermodulation, although this is nowhere near as bad as *some* amateur handheld transceivers I've used!

Lab tests

The measured receive sensitivity was very good. the adjacent channel and other strong signal rejection levels being fairly reasonable for such a set. The transmitter power levels were ample and nicely regulated, the harmonic suppression excellent, although the peak deviation setting was just a little high.

The set uses negative injection for it's receive side, with a 1st IF of 21.7MHz and 2nd IF of 450MHz, thus giving images below 2m rather than above to help the dreaded 'paging breakthrough' to some degree. I did still have the odd problem from this on air, but again nowhere near as badly as from some sets I've tested.

Conclusions

The DJ-190 is a very easy-to-use set, having all the features most amateurs need, at a very reasonable price. I was very pleased indeed with it's sensible operating features, especially when used in channel-only memory mode. It has a respectable on-air performance as a handheld for the price, although I feel users in fringe areas could usefully substitute a larger and/or more efficient set-top aerial to get the very best out of the set.

My thanks go to Waters and Stanton Electronics for the loan of the review transceiver.

Next month's magazine will have a free competition to win a DJ-190, with five runners-up prizes of 'Scanning Secrets' books, all kindly donated by Waters and Stanton, - don't miss it! Keep hold of this magazine, as you will need to refer to this review for the answers to some of the questions.

LABORATORY RESULTS:

All measurements taken on 145.0MHz using fully charged 4.8V nicad, RX power saver disabled, high power TX, unless otherwise stated.

RECEIVER;

Sensitivity;

Input level required to give 12dB SINAD;

144MHz;	0.12µV pd
145MHz;	0.12µV pd
146MHz;	0.12µV pd

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;	19.6dB
-12.5kHz;	30.2dB
+25kHz;	62.6dB
-25kHz;	63.7dB

Intermodulation Rejection;

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

25/50kHz spacing;	65.5dB
50/100kHz spacing;	66.6dB

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;

Half 1st IF;	67.0dB
1st Image;	61.1dB
2nd Image;	69.4dB

S-Meter Linearity;

	Sig. Level	*Rel. Level*
1	1.23	0dB ref.
2	1.59	+2.2dB
3	2.08	+4.5dB
4	2.73	+6.9dB
5	3.69	+9.6dB
6	4.36	+11.0dB

Current Consumption;

Standby, squelch closed;	59mA
Receive, mid volume:	96mA
Receive, max volume;	145mA

Squelch Sensitivity;

Threshold;	0.09µV pd (7dB SINAD)
Maximum;	0.22µV pd (25dB SINAD)

Maximum Audio Output;

Measured at 1kHz on the onset of clipping (10% distortion), 8 ohm load;

208mW RMS

Blocking;

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

+100kHz;	77.1dB
+1MHz;	93.5dB
+10MHz;	95.2dB

TRANSMITTER

Peak Deviation;

5.65kHz

Toneburst Deviation;

3.11kHz

Frequency Accuracy;

-140Hz

TX Power and Current Consumption;

Freq.	*Power*	*4.8V Supply*	*7.2V Supply*	*9.6V Supply*
144MHz	High	1.75W/930mA	3.88W/1.24A	5.61W/1.39A
	Low	870mW/615mA	900mW/600mA	910mW/605mA
145MHz	High	1.78W/950mA	3.88W/1.26A	5.56W/1.40A
	Low	860mW/620mA	900mW/605mA	910mW/610mA
146MHz	High	1.83W/975mA	3.93W/1.28A	5.50W/1.38A
	Low	860mW/620mA	900mW/605mA	910mW/600mA

Harmonics;

2nd Harmonic;	-76dBc
3rd Harmonic;	-89dBc
4th Harmonic;	<-90dBc
5th Harmonic;	<-90dBc
6th Harmonic;	<-90dBc
7th Harmonic;	<-90dBc

Ex-PMR Conversion - SMC545L1 & SMC1045L2

Fancy a brand new 70cm mobile for around £30? Well here's your chance, as Chris Lorek gets his conversion hat on once again

Many amateurs take a 'gamble' when buying an ex-service PMR (Private Mobile Radio) transceiver for conversion to the amateur bands. Having been in commercial use, there's a chance it could be faulty, or missing a vital part, or "beyond economic repair", which could be why it's on sale in the first place. I normally always advise on buying from someone with a pile on sale, as they usually are, having been a batch ex-service sets that have simply been updated with later equipment in a given communications fleet.

In the past, at least one UK PMR dealer (see review in HRT Feb '94) has offered quantities of brand new PMR rigs onto the amateur market. SMC, who are also well known in the international professional radio systems market, are now doing likewise with two of their early UHF mobile rigs, the SMC545L1 and SMC1045L2. These have been advertised for a short while now, and I've had a number of requests for modification details.

The sets are currently available as brand new and boxed, and I'm told that visitors to their London Show stand this month will be able to pick them up for around £30 each. The best news is that SMC have kindly agreed to give a £5 discount off the stand advertised price of these if you wave this copy of Ham Radio Today at them! (thanks lads). Their reason for selling them off so cheap, well below 'cost' of course, is the need to free up storage space for new products! I'm not arguing, here's the information you've been asking for, so here goes...

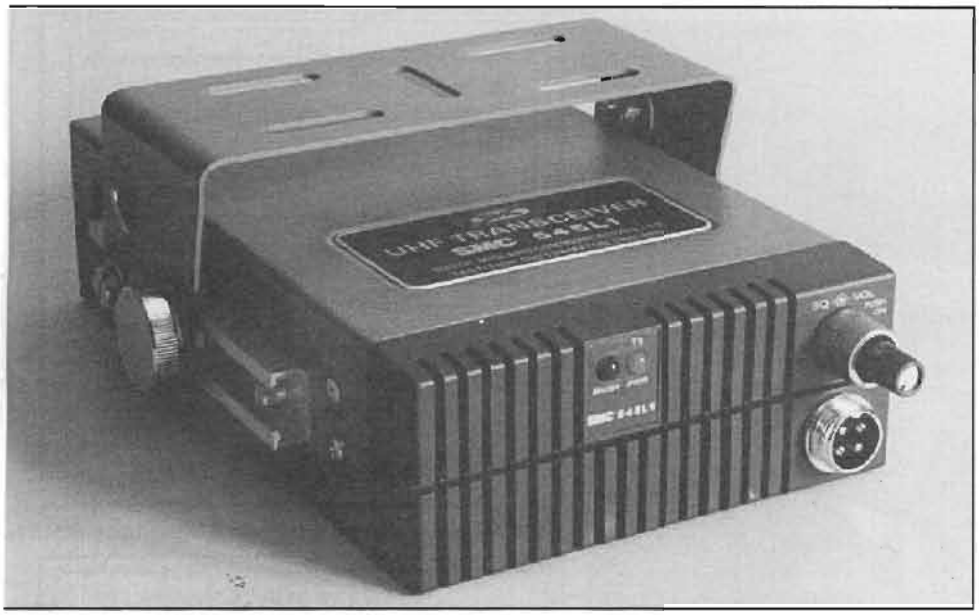
Identification

The ***SMC545L1*** is a 10W (5W initially), single channel, crystal controlled UHF rig. The '5' stands for 5W, '45' stands for 450MHz range, 'L' means land mobile, and '1' means single channel. The set is rated at 10W output, and can be used as such - it was simply type-approved for 5W operation in the UK. The ***SMC1045L2*** is a 10W two channel crystalled rig. It follows the same numbering arrangement as the SMC545L1, this time the '10' stands for 10W, '45' again stands for 450MHz range, 'L' means land mobile, and '2' means two channel. Fortunately, both sets are clearly marked with these designations on their identification labels, although beware that there are also similar-looking VHF sets (with different type numbers), so don't be fooled by appearances. It may be of interest to note that the 1045L2 can also be used as a full-duplex rig, i.e. simultaneous receive and transmit, on different frequencies and with suitable aerial isolation, by using the separate TX and RX boards independently

There are two important things to note when acquiring your set, the frequency range, and the channel spacing, neither of which are marked on the set itself. Firstly, each comes in two frequency band variants, 420-440MHz, which are the 545L1(B) or 1045L2(B) models, and 450-470MHz, which are the 545L1(D) and 1045L2(D) models - this is marked on the box rather than the set. The B model is fine for 70cm, and is the one to go for if you want a 'hassle free' tune-up. Either 1045L2 model can actually be aligned anywhere between 420-470MHz, it just comes 'pre-aligned' for the appropriate band segment. However, I'm reliably informed that the 'D' model of the 545L1 will 'pull' no lower than around 435-438MHz without modification. This involves internal changes to the front end helical filtering stages (not to be recommended for the faint-hearted), and you'll find the transmit power reduced towards the lower end of 70cm unless you change the transmitter PA module to the correct type.

The band variant letter is normally marked on the set's box, but not on the set itself. However, regarding the 545L1 *only*, many 'B' models were originally marked in Japan as 'D' models on the box (just to confuse things!). The way to check if you're unsure is to open the set up and look at the TX PA module. This will be marked as M57704L for 420-440MHz, and M57704H for 450-470MHz.

Next comes the channel spacing, which can be either 12.5kHz or 25kHz, the narrower type usually being marked with '/N' following the type designation on the set's box, but not on the set itself. With the possible move to 12.5kHz



The SMC545L1, a 10W, single channel rig

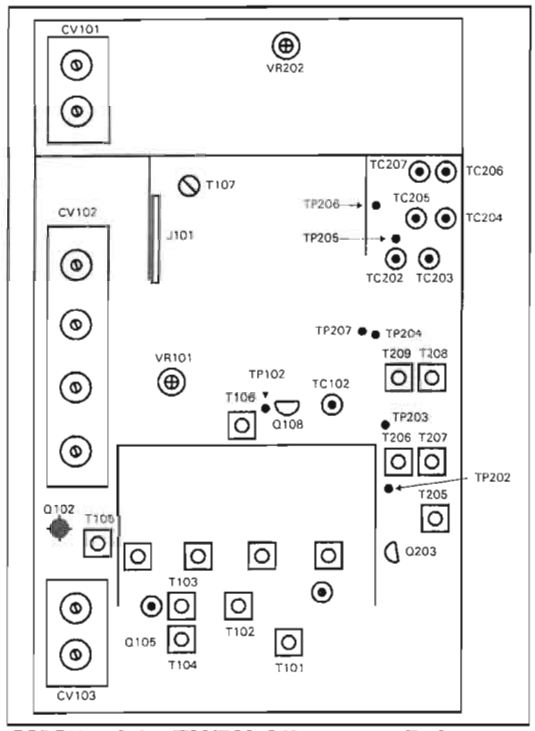
channel spacing in the future, I'll leave the choice up to you - I personally have no problems with the 12.5kHz 545L1 set used here, although conversion to 25kHz means just a few filter and component changes, detailed later. Besides asking the dealer, the channel spacing is easily identified by taking a look at the two small grey or black plastic cased ceramic filters in the receiver section of either set. A marking on these of *LF-B8* (8kHz bandwidth) means 12.5kHz, *LF-B15* (15kHz bandwidth) means 25kHz spacing.

Crystals

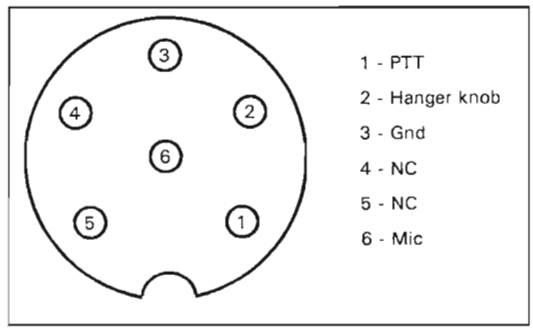
Each set uses identical crystal types and multiplication factors, these are given in the accompanying table. Remember that you'll need one crystal for the receive frequency, and one for transmit, suitable plug-in crystals are available from sources such as Quartslab in Kent. You'll find crystal suppliers in Ham Radio Today ads, and a list of several suppliers is given in the Surplus 2-Way Radio Conversion Handbook (available from Poole Logic)

545L1 alignment

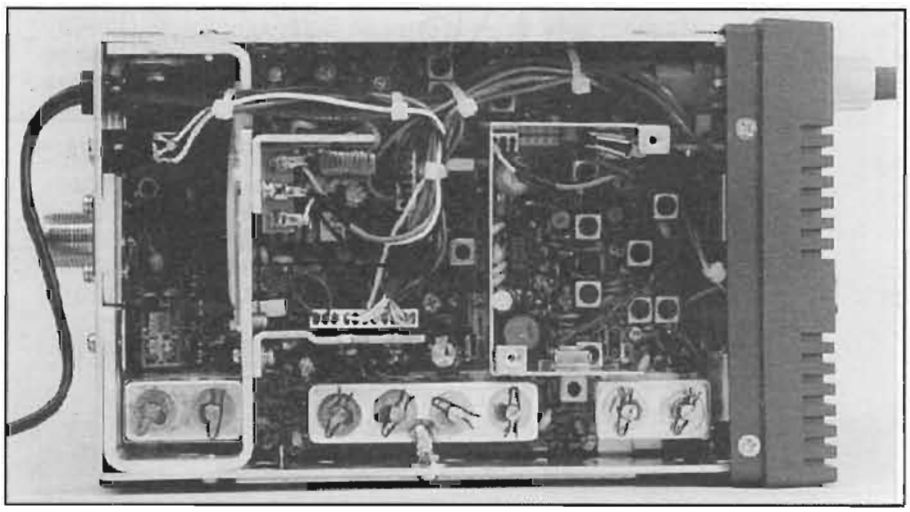
We'll start off with the receiver multiplier first. With your crystals plugged in, first adjust the crystal trimmer capacitor so you can at least hear *something* from a strong off-air signal, or signal generator, on the wanted frequency. Then, connect an RF voltmeter (if you have one) or a diode probe, to the base of Q105, adjusting T103 and T104 for maximum reading. Then transfer to gate 2 of Q102, and adjust CV103 for maximum indication. If you don't have the required meter, then adjust all these for best received signal (maximum quieting). Now for the RF section. With a received off-air signal (or from a signal generator), adjust the eight trimmers on CV101, CV102 and CV103 for best received signal (maximum quieting). That's it, you should now have a working receiver, although you may wish to repeat these adjustments on a weak received signal to achieve absolute best quieting. Now re-adjust the crystal trimmer for 'spot-on' tuning, and that's it for the receiver. If you have a frequency counter, you can tap onto the base of Q105 via a 10n capacitor and adjust the crystal trimmer for a precise receiver injection frequency, in this case the receive frequency minus 21.4MHz,



SMC545L1 - TX/RX Alignment Points



SMC545L1 - Mic socket connections



Inside the 545L1

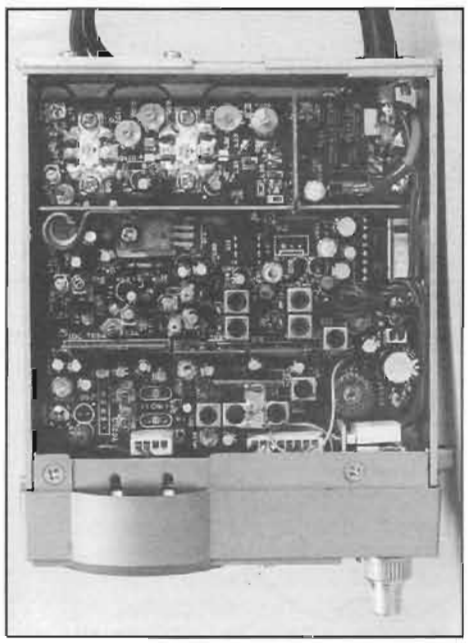
The SMC1045L2, a 10W two channel rig

all divided by 3. Don't adjust T101 for frequency compensation, as its adjustment is very critical - use correct crystal trimmer capacitor instead.

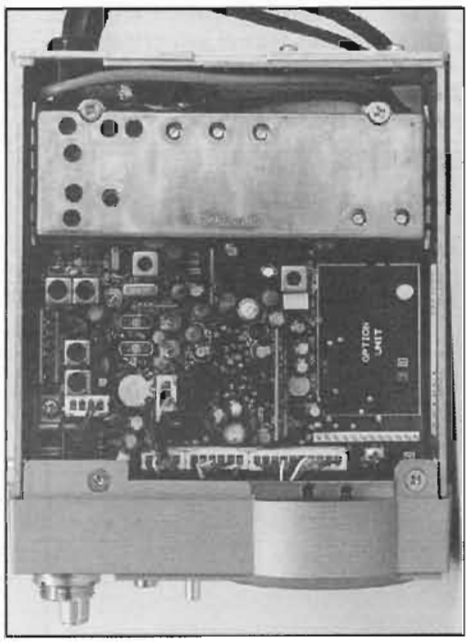
On the transmit side, connect a dummy load to the aerial socket, with some form of relative power meter indication in line. With the transmitter keyed, adjust T203 for maximum reading on an RF voltmeter or diode probe on the base of Q203. Transfer to the base of Q201, and adjust T202 for maximum, then detune it until 80% of the maximum reading produces a stable output. Don't adjust T201, it's for frequency compensation and it's alignment is again very critical. Now for the multiplier stages.

Turn VR202 fully clockwise, and connect a DC voltmeter between TP202 and ground. Adjust T205 and T206 for minimum indication on the voltmeter. Now connect the meter to TP203, and adjust T207 and T208 for minimum indication on the meter. Transfer to TP204, and adjust T209 for minimum reading. Transfer to TP205, and adjust TC202 and TC203 for minimum reading. Transfer to TP206, and adjust TC204 and TC205 for minimum reading.

By now, you may be seeing an indication of RF power, so readjust T206 to T209 and TC202 to TC207 for absolute maximum RF power.

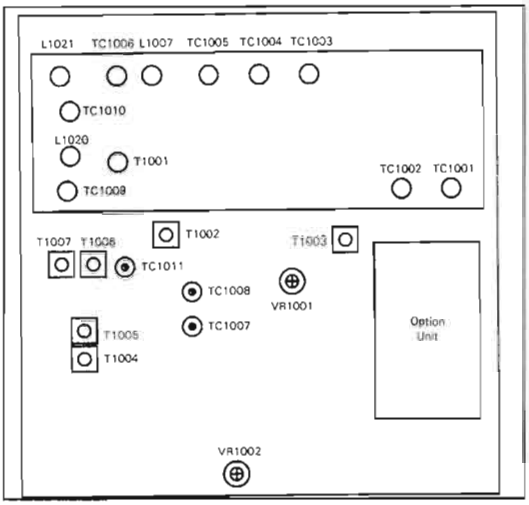


The 1045L2 transmitter section

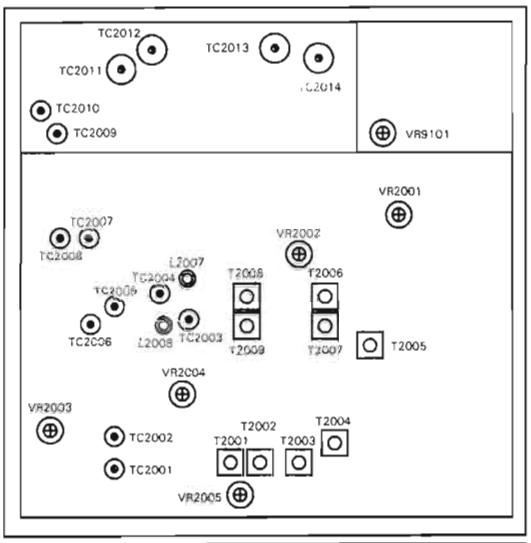


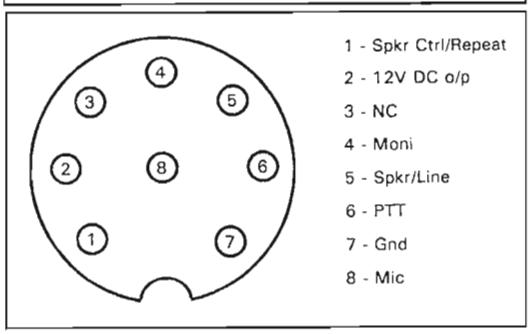
The 1045L2 receiver section

SMC1045L2 - Receiver Alignment points



SMC1045L2 - Transmitter Alignment Points





SMC1045L2 - Mic socket connections

Adjust the crystal trimmer for the exact required transmit frequency. The peak deviation control is VR201, which you should adjust for a maximum of 5kHz deviation. If you've access to a distortion meter, then you can adjust T203 and T204 for minimum distortion, re-adjusting the peak deviation as required. VR202 adjusts the RF power output, which should be set to around 10W to guard against overheating.

That's it, you should now have a fully operational set, ready for your first contact.

1045L2 alignment

First of all, plug in your receive and transmit crystals, switch on, and adjust the receiver crystal trimmer capacitor so you can at least hear a signal on your chosen channel (i.e., tune it onto channel). Remember to select the correct channel with front panel switch! Now adjust TC1006 to TC1006, TC1009, and TC1010, T1001 and T1002 all for best quieting of the received signal, reducing the level of this as needed. Finally, repeat these adjustments on a weak signal to achieve the very best sensitivity possible, re-aligning the crystal trimmer for 'spot-on' reception as needed. If you've a frequency counter, you can measure and thus set the receiver local oscillator injection frequency precisely (in this case the receive frequency minus 21.4MHz) - tap onto the base of Q1004 via a 1nF capacitor to measure this.

The transmitter alignment is similarly easy. With the transmitter keyed, adjust T2005 to T2009, TC2003 to TC2006, and TC2007 to TC2014, all for maximum RF output power. Then adjust VR2002, the RF power level control, for 10W RF output. Finally, adjust the relevant crystal trimmer capacitor for the correct transmitter frequency. The peak deviation control is VR2004, which you should set as needed (e.g. 5kHz maximum deviation), and VR2003 is the mic gain adjustment. That's it for the 1045L2 alignment.

Channel spacing mods

If you wish to change the channel spacing, you'll need to change the two plastic-cased 455kHz ceramic filters, and the two small 21.7MHz monolithic dual crystal filters (which look like tiny metal-cased crystals). After replacement, each set should then operate satisfactorily for amateur purposes. However, if you'd also like to 'fine tune' the crystal filter matching, after changing to 25kHz filters, on the 1045L2 change capacitor C14 to 5p and resistor R10 to 1k8, and on the 545L1 change C149 to 7p and R121 to 1k.

9600 baud packet mods

If you'd like to use the set for 9600 baud packet, you'll first need to ensure you've a 25kHz channel spacing set, and I'd advise performing the filter matching component changes also. You'll need to extract the receiver audio direct from the discriminator, here you can tap off from the junction of R144 and R146 on the 545L1, and the junction of C031 and C032 on the 1045L2. On transmit, you should feed audio directly to the transmitter modulator - for this tap into the junction of R214, R215 and R216 on the 545L1, and the junction of R015, R016 and R017 on the 1045L2.

Ready to go

You should now have a 'ready to go' transceiver for on-air use. If you'd like a full circuit diagram and board layout, these are available for up to the next 12 months as a service to Ham Radio Today readers. Just send a large SAE marked "1045 mod info" or "545 mod info" as appropriate (or both if you wish - in which case ensure sufficient postage or IRCs for 50g weight is attached) together with the *original* corner flash from this page (photocopies will *not* be accepted), to the Ham Radio Today Editor at the magazine address. Have fun with your set! Any reported updates to this conversion will be available on the 24hr Ham Radio Today voicebank and fax-back information line, Tel. 01703 263429.

My thanks go to SMC for the provision of the two sets for conversion. SMC have kindly agreed the sets used here to be donated to benefit amateur radio, one towards a packet linking node, the other to a local school novice club station, both will by now be in use by these stations.

Table 1. Crystal Data

Type;	HC-25U or HC-42/U
Osc. Freq.;	(TX Ch)/12 (RX Ch-21.4MHz)/9
Load capacity;	TX, 40pF + 50Hz RX, 32pF - 120Hz
Drive level;	TS683/TMS 2mW
Shunt capacity;	TX, 4.7pF +/-0.5pF RX, 4.4pF+/-0.5pF
Equiv. ser. res.;	16 ohm
Mode;	3rd overtone

Table 2. Crystal Frequencies

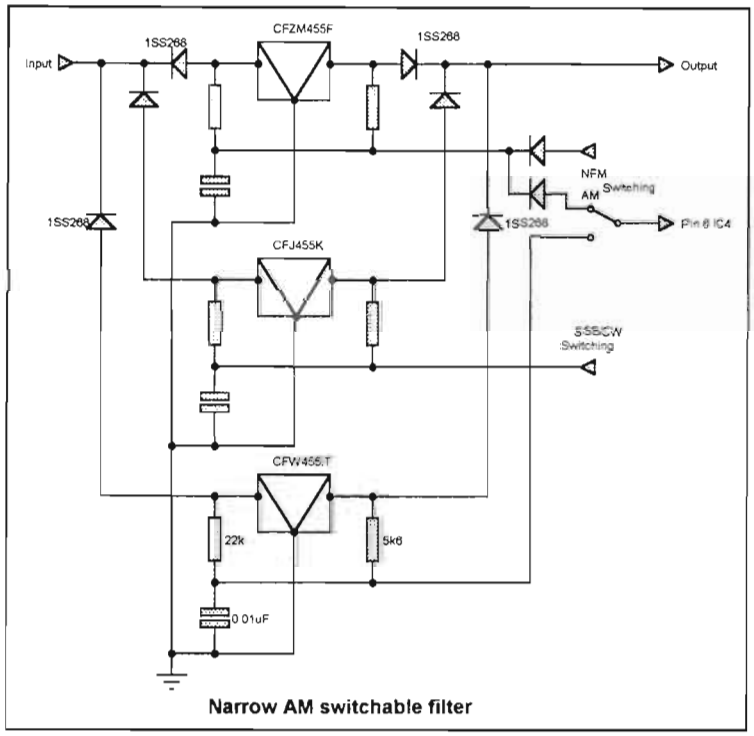
Chan	*TX*	*RX*
RB0	36.21667	45.73096
RB1	36.21875	45.73373
RB2	36.22083	45.73651
RB3	36.22292	45.73929
RB4	36.22500	45.74207
RB5	36.22708	45.74484
RB6	36.22917	45.74762
RB7	36.23125	45.75040
RB8	36.23333	45.75318
RB9	36.23542	45.75596
RB10	36.23750	45.75874
RB11	36.23958	45.76151
RB12	36.24167	45.76429
RB13	36.24375	45.76707
RB14	36.24583	45.76984
RB15	36.24792	45.77262
SU16	36.11667	45.77540
SU17	36.11875	45.77818
SU18	36.12083	45.78096
SU19	36.12292	45.78373
SU20	36.12500	45.78651
SU21	36.12708	45.78929
SU22	36.12917	45.79206
SU23	36.13125	45.79485
432.625	36.05208	45.68929
432.650	36.05417	45.69207
432.675	36.05625	45.69484
433.625	36.13542	45.80040
433.650	36.13750	45.80318
433.675	36.13958	45.80596

Table 3. Channel spacing filter changes

Ch Spacing.	*Cer. Fil*	*Xtal Fil*
12.5kHz	LF-B8	21J2F2
25kHz	LF-B15	21J2B2

AR-3000A Modifications (part 2)

The Ham Radio Today Editorial staff show how to improve the AR3000 and AR3000A with the switchable narrow AM filter, tape recorder compatibility and 10.7MHz output mods



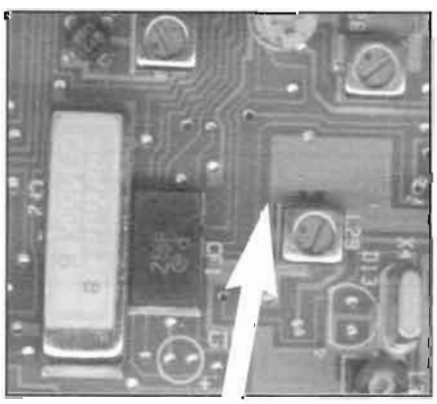
Narrow AM switchable filter

The first part of this article appeared in last month's issue of Ham Radio Today. Back issues are normally available for the next 12 months from the Nexus Back Issues dept.,Tel. 01858 435344

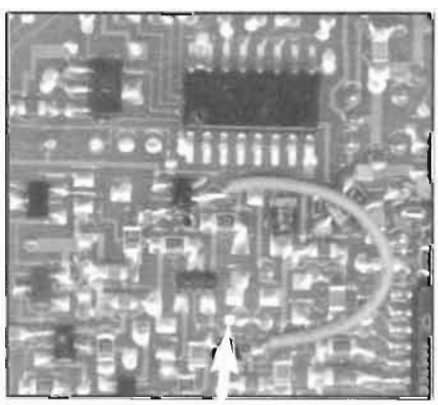
This narrow AM filter modification has been designed to optimise the receiver's passband for reception of short wave AM broadcast transmissions. Generally speaking, on long and medium wave a 9kHz channel spacing is used (in Europe) and a 5kHz channel spacing for short wave. The standard AR3000A AM filter is 12kHz wide, this has the advantage of permitting reception of 'offset' civil airband transmissions, the same filter is also used for NFM.

This modification adds a rear panel switchable narrow AM filter. The same switch is also used for WEFAX switching described last month, both are switched at the same time if both options are fitted. The filter specification bandwidth is 4.0kHz, but when fitted in circuit it's actually wider than this. There is still a very worthwhile improvement which helps reduce blocking when listening close-in to a strong transmission, heterodynes may also be reduced or removed when listening to many transmissions. There is also a small increase in sensitivity, by a few dB, over the standard filter.

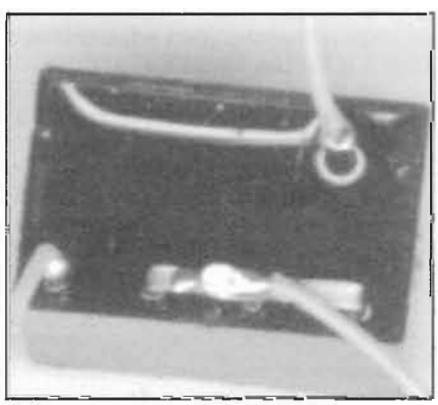
The additional narrow AM filter is fitted to the IF PCB, with the data lines used to select the filter by diode switching in conjunction with the rear panel switch. The reception



AM filter mod - drill 0.8mm dia hole



AM filter mod - drill 0.8mm dia hole



Pre-wiring the AM filter

of NFM is still routed through the standard filter even when the narrow AM filter is selected.

When the narrow AM filter is selected, the squelch closing position is affected. Instead of closing around 11 o'clock, it closes around 2 o'clock, although this is not a problem as the squelch is usually left 'open' when monitoring HF broadcast transmissions. The squelch characteristic is normal and unaffected when in the standard filter position. The bandwidth is of course *not* selectable via computer control.

The filter used is a CFW455IT, Bonex part no 080079. The filter sits on a blob of hot melt (i.e., use a 'glue gun' or similar) between L29 and the existing AM filter, and is prepared in such a way that, of its three connections, the input and output legs are extended and pass through holes in the PCB and the earth connection sticks out of the side of the hot melt and solders to the earth plane on the top side of the board.

Move the grey loop of wire on the underside of the IF board as far to the right of the PCB as possible, and drill a 0.8 mm diameter hole through the board next to L29 on the IF PCB and suck the solder from the second hole if filled. Cut the input and output leg of the filter short, and solder a 50 mm length of kynar wire vertically to each. Cut the middle leg of the three earth connections short, and bend and cut the outer two to meet it. Solder all three together, and add a 50 mm kynar earth wire to exit horizontally to the filter towards the front of the set. The overall effect is that the filter should be able to sit low in its blob of hot melt with its top level with the Murata SSB filter CFJ455K, its two vertical wires through the prepared holes and the earth connection available to be soldered as close as possible to the earth land on the top of the PCB.

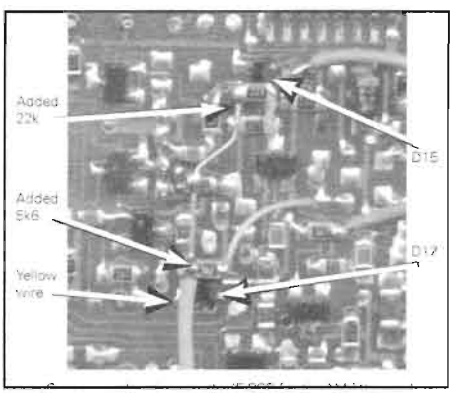
On the underside of the board, add two 1SS268 SMD diodes 'piggy backed' onto two existing diodes D15 and D17. The 1SS268 is a double diode package, but only one diode in each is used. Solder the front pins only. Add a 22k SMD resistor to the front anode of the diode above D15 and a 5k6 SMD resistor to the rear anode of the diode above D17

Connect the non diode ends of the resistors together with a piece of tinned wire and connect a 0.01µF SMD capacitor between this tinned wire and an earth plane. Connect a 300 mm length of yellow wire to the aforementioned tinned wire and connect the kynar wires that are protruding through the board from the filter to the diode ends of the resistors, one to each. Cut the track to pin 6 of IC4, and connect a 300 mm blue wire to the now isolated pin. Connect a 300 mm green wire to the right hand anode of D19. Insulate the delicate surface mount work with hot melt.

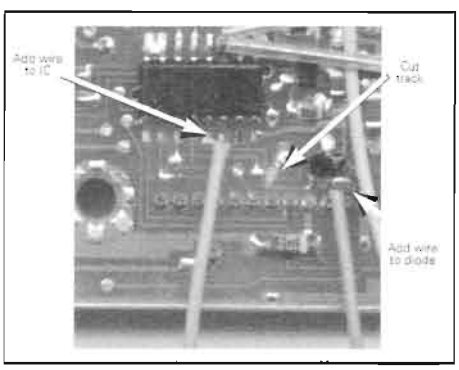
Refit the IF board, twist the blue, yellow and green wires together and run them down the right hand edge of the IF board with the main loom. Follow the main loom towards the position of the new slide switch.

Using a sharp knife cut out the hole in the rear panel escutcheon next to the aerial socket, to allow a miniature DPDT slide switch to be fitted. Drill out the mounting holes and fix the switch, e.g. using two M2x4 screws. Trim and solder the blue, yellow and green twisted wires to one set of switch contacts connecting the yellow to the top connection, the blue to the middle connection and the green to the bottom connection.

To test the unit, tune to a broadcast AM station and switch the narrower filter in. You should hear a narrowing of tonal quality and a reduction in adjacent channel interference. Refit the case halves and the modification is complete.



Component locations on the IF PCB for the AM filter mod



Added AM filter switching to the IF PCB

Table 2. AM Filter mod parts list

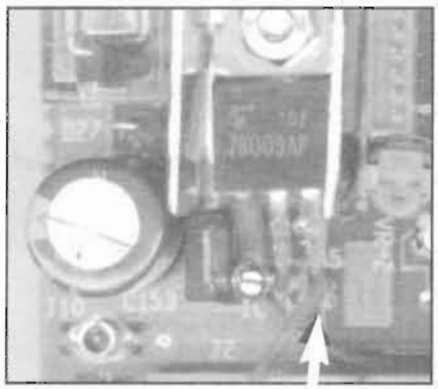
2 x 1SS268 SMD diodes
1 x 22k SMD resistor
1 x 5k6 SMD resistor
1 x 0.01~µF SMD capacitor
1 x Murata SSB filter CFJ455K
Wire links as described

Tape recorder compatibility

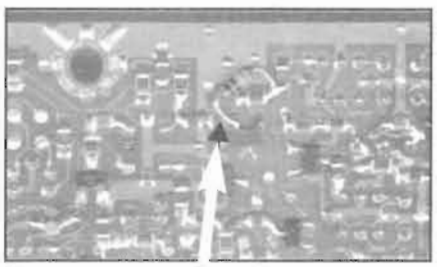
This modification enables the AR3000A to provide better compatibility with a range of 'off the shelf' tape recorders. The AR3000A/3000 receiver uses a pair of Darlington transistors for tape motor on/off control. While this is suitable for many machines, some require independent relay contacts.

The modification consists of a small internally fitted double pole 'slave' relay, driven by the switching transistors. One pair of relay contacts feed back to the AUX socket via a 10 ohm resistor (to prevent relay sticking) and provides independent relay contacts not referenced to ground. The second pair of contacts feed audio to the AUX socket when the squelch is open with a high value resistor preventing noise pickup when the contact is open. Constant level audio is still fed to another pin of the AUX socket, taken from a point before the relay (audio is permanently fed so that users may decode CTCSS signals without encountering any squelch rise time). This makes the tape output modification ideally suited for direct DC switching of tape motors (*not* mains!) and for voice activated systems. AOR can, if required, provide an optional tape lead (type CR400) which terminates in 3.5 mm mono plugs for audio and a 2.5 mm plug for tape motor control.

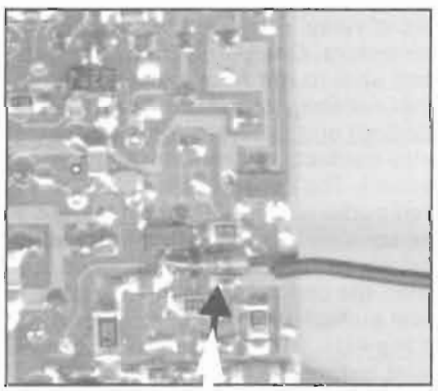
Begin the modification by removing the DC socket and AUX socket. Remove the brown and white wires from pins 6 and 7 of the AUX socket and connect the white wire to a +12V supply on the rear of the power socket, or pin 3 of the AUX socket if available (this was not fitted on earlier models). Remove the 220k resistor from pins 4 and 5 and connect a 100k resistor from pin 5 to pin 2 (Ground). Connect a pair of 100 mm blue wires to pins 6 and 7 and a



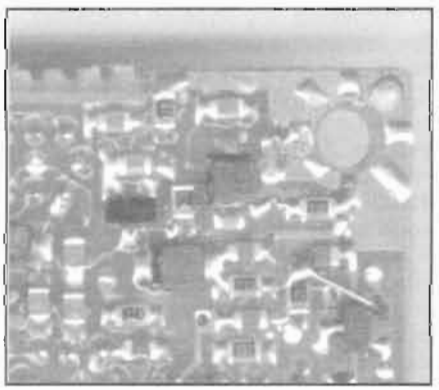
Add 9V feed from regulator



Connect a 470R resistor between Q7 emitter and C45/R29 junction



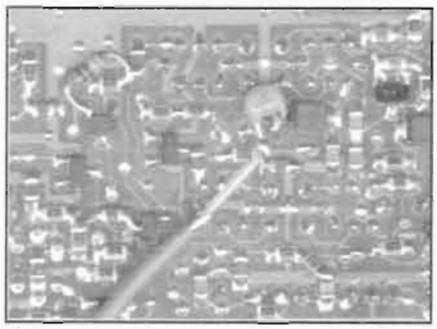
Add a 1N4148 diode



Short Q9 emmitter/collector with small piece of wire

pair of 100 mm yellow wires to pin 4 and 5. Refit the AUX socket and DC socket.

Using a 12V double pole relay with internal diode protection, trim and



Add capasitor ans Co ax to the IF PCB

solder the pair of blue wires to one pair of normally open contacts. Fit a 10R 1/8W resistor in series to prevent the relay contacts sticking. Trim and solder the yellow pair of wires to the second pair of normally open contacts on the relay.

Connect the brown wire removed from the AUX socket to the +ve coil connection on the relay, and connect a black wire between the -ve connection and an earth connection (remote socket PCB). Mount or otherwise secure the relay to the inside of the rear panel, check the switching operation and refit the case halves. That completes the modification.

AUX Socket connections

Pin2: Ground
Pin4: Constant audio out
Pin5: Squelch operated audio output for VOX
Pin6: Relay switch contact
Pin7: Relay switch contact

10.7MHz IF output

This details a mod to allow a 10.7MHz IF output to be taken from the receiver, for use with an external spectrum analyzer or monitor, such as the AOR SDU5000 Spectrum Display Unit. The SDU5000 is designed to complement the AR3000A (and other receivers), although the AR3000A needs a mod to ensure it will 'plug in and go'. The Display Unit adds a variety of features to extend a receiver's capabilities, such as visually identifying new active frequencies and taking measurements. It produces a bandwidth up to ± 5 MHz in 1 kHz increments with a resolution of 5 kHz or 30 kHz.

Note that the AR3000 does not provide microprocessor compatibility with the SDU5000, so only basic facilities are available. However, the AR3000A has been designed to provide best compatibility by communicating directly via the receiver's CPU via the RS232 port / SDU5000 COM1 to make sure the full potential of the SDU can be exploited.

This modification adds a rear panel BNC socket providing the required 10.7 MHz IF signal, with a bandwidth of 10MHz and gain of about 10dB compared to aerial input. A rear panel toggle switch provides AGC / mute for the SDU, normal is *up* and active is *down*, the normal position being used most of the time. Of course the switch is *not* selectable via computer control. To begin, add a 1N4148 diode to the board as shown. Connect the cathode to the anode of D7 and connect a 300 mm black wire to the anode. Connect a 470R, 1/8W resistor between the emitter of Q7 and the junction of C45 and R29 as shown. Short the emitter to the collector of Q9 with a small piece of tinned wire as shown. Add one end of a 1000pF ceramic capacitor to the junction of L23 and C48. To the other end connect the inner of a 250 mm length of miniature 50 ohm coaxial cable. Connect the braid to the nearest suitable earth plane. Insulate all fragile connections with a blob of hot melt and refit the board, making sure that the coaxial lead and the black single wire exit from under the rear right corner of the board.

Connect a 150 mm red wire to the 9V output of regulator IC11 (right leg, as shown) and run towards the back of the board. Using a sharp knife cut out the rear panel escutcheon below the aerial socket and file away one of the flats to allow the fitting of a BNC socket. Hot melt the coaxial cable along the bottom of the 25 way remote connector and trim and solder it to the new BNC socket. Remove the DC socket and find the hole in the rear panel just below the DC socket hole, puncture the escutcheon and using it as a pilot hole drill a 6.5 mm diameter hole and fit a miniature SPDT toggle switch.

Trim and solder the black wire to the middle connection of the switch and trim and solder the red wire to the top connection of the switch. Refit the DC socket. Check the operation of the modification with an SDU5000 or spectrum analyzer, refit the cases, and the modification is complete.

If there are any reported updates to these two articles, the details will be available for the next 12 months on the HRT voicebank information line, Tel. 01703 263429. For information on obtaining a free set of circuit diagrams and other information, see part 1 of this series.

SCANNERS

Bill Robertson reveals details of two new UK bands for Private Mobile Radio

With memories of the now-famous 'UFO encounter', where the Lincolnshire police force reportedly put out a fake message on their radio network of a UFO landing, and waited to catch scanner users who turned up at the reported landing site, I've often been asked if I know of similar measures taken by other police forces. The 'UFO' one is often reported in different counties, but rumour has it that recently, in Oxfordshire, a variation on the theme was a similar fake message of bank robbers being chased through a wood, leaving a trail of scattered bank notes. But the end result, I'm informed, was very similar!

New UK PMR bands

To meet the increasing needs of business communication, there are a couple of new frequency bands coming into operation for two-way PMR (Private Mobile radio) in the UK. The first is the *Short Range Business Radio* service, which is intended for 0.5W UHF handhelds throughout England, Scotland and Wales. The speech frequencies, which are now available, are 461.2625MHz, 461.4750MHz and 461.4875MHz, all simplex. The idea is for a simple licence, and business use on a 'non-protected' basis by anyone on any of these frequencies. So you should find these getting *very* busy in the months to come!

A further band, due to be allocated, is down in the old Band I TV spectrum, with 55.75-60.75MHz and 62.75-67.75MHz being allocated to two-way radio. This, however, is likely to be a 'regulated' frequency band, i.e. with users being granted licences for a given frequency or frequencies. The band is also being sub-divided into a number of sub-bands. CBS (Common Base Station) use, i.e. 'community repeaters' will have their base transmit on 57.5-60.75MHz, with mobile transmit on 64.5-67.75MHz. The rest is for 'normal' PMR, with base transmit on 62.75-64.5MHz, and mobile transmit on 55.75-57.5MHz. All these sub- bands will use 12.5kHz channel spacing.

Beginner's guide

Trevor Budd from Plymouth says he's a beginner to scanning and wants to purchase a decent scanner. He asks what specification and features he should look for in a suitable scanner, how much should he pay to get a good model, and what's the best model to go for.

This is a typical question, and the answer really depends upon what you want to listen to, what external aerial, if any, you can manage to use, and of course, what your budget is. Fortunately, the 'Which Receiver' feature, published in the Scanners International section of the October 1993 issue of Ham Radio Today, gives most of the answers. The Editor tells me this is available by requesting the 'Beginner's Pack' from HRT, all you need do is send an A4 sized SAE, stamped for 150g weight, and you'll receive a bumper collection of help in getting started. If you've Internet web browsing facilities, the guide to choosing your first receiver is also on the Ham Radio Today WWW site, http://www.tcp.co.uk/~slorek/

Cordless phones

Robert Eisner asks about the cordless phone frequencies used in the UK. The list shown here gives details of the CT1 (Cordless Telephony '1') frequencies used, the lesser-used CT2 'Rabbit' types being digital handsets operating on around 840MHz. Unlike CT2, normal 'analogue' FM is used for CT1, the handset transmitting in the 47MHz range and the base, which also usually carries 'sidetone' (i.e. both sides of the conversation) transmitting in the 1.6MHz range. You'll sometimes find the frequencies are 'paired' for two-channel cordless phones, these being channels 1 & 4, 2 & 5, 3 & 6, 4 & 7, and 5 & 8.

Scanner mods

Richard Kalton says he wants to tap into the discriminator output of his PRO-46 scanner to aid decoding of FSK data. As this a fairly early scanner, I don't have details here, but you'll usually find that one of the pins on the IF subsystem IC (e.g. pin 9 on the commonly-used MC3357) carries this. A check with an oscilloscope often reveals which pin, or of course a bit of prodding with a high-impedance probe (or series resistor and capacitor) into an audio amplifier. If any readers have more specific information, please let me know and I'll be pleased to pass it on.

Kevin G7NXA has an old AOR AR-800E scanner and is interested in any mods for it. It's lowest frequency band is 75-105MHz, and he's particularly interested in getting it to cover down to 70MHz, or indeed 50MHz if possible. I'd guess this frequency range is 'locked' into the programming of the set, but if readers have any mods I'll be pleased to publicise them, or if you're on packet you can contact Kevin directly ; G7NXA @ GB7DAD.#23.GBR.EU

Realistic have just released a new handheld, the 30 channel PRO-28, covering 29-50, 50-54, 137-174, and 406-512MHz (you'll see a review in next month's issue - Ed).

That's it for this month, but the Editor's got me helping the team to prepare a 'scanner special' for this issue with book reviews and a scanner mod, so do read on! As usual, if readers would like any specific scanning topics covered in this column, or if I can help with a question on hobby radio listening, just drop me a line. See you next month.

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.

CT1 Cordless phone frequencies

	Handset TX	*Handset RX*
Ch1	47.45625MHz	1.642MHz
Ch2	47.46875MHz	1.662MHz
Ch3	47.48125MHz	1.682MHz
Ch4	47.49375MHz	1.702MHz
Ch5	47.50625MHz	1.722MHz
Ch6	47.51875MHz	1.742MHz
Ch7	47.53125MHz	1.762MHz
Ch8	47.54375MHz	1.782MHz

Choosing and Using Ex-PMR Gear

Ham Radio Today's Consultant Technical Editor gives an insight on what to look for, and what to avoid!

One of the popular 'themes' that Ham Radio Today is renowned for is ex-PMR (Private Mobile Radio) conversions. It's little wonder, because for just a few pounds you can get yourself up and running on VHF and UHF, rather than spending over £200 or so, often a lot more, on a commercially made 'black box'.

The equipment usually comes onto the market because of changing PMR technical parameters, so that many sets can't be economically re-used.

Another is that sets have come to the end of their useful life in a large fleet, and are replaced with more modern equipment. The result in either case is that they're often sold for 'scrap value' only. This is where we come in! But here are a few points to watch out for when buying.

Bargains to be had

You'll usually always find the best bargains are to be had from a rally stand. Although buying by mail order has its advantages, for example does all the hard work for you in identifying the set, you'll normally find that better bargains are to be had by paying them a personal visit. They often have a smaller number of sets that possibly aren't worth advertising (I've seen this *many* times), and they're pleased for you to 'take them off their hands'. Likewise, you virtually always find good bargains at rally stands, especially the smaller, local rallies where the traders often have smaller overheads.

Lookalikes

PMR manufacturers usually make a given range of equipment in different frequency bands, even though the sets look the same on the outside. Don't be tempted to think that the set you see on a rally stand which looks like an MX296 (70cm FM) really is - it could easily be an MX294, for either 2m or 4m FM, or an MX293 for 4m AM. Little use if you buy the latter and only find out when you get home! The moral is to check first - look at the serial number plate which gives the model type.

Synthesized or crystal?

If you want the greatest flexibility in terms of channels, for a mobile rig for example or a primary base station 'natter rig', then you should choose a synthesized set. Above two or three channels, the cost of crystals can easily be more than the set itself cost, so the extra complication and cost of a synthesized ex-PMR set could pay great dividends. However, for a single or two channel set, for example for packet, or to permanently listen out on a local club net or RAYNET channel, a crystal controlled set can be a *very*, very cheap solution.

Conversion

Many sets are capable of being re-tuned to the amateur frequencies without any form of circuit modification, apart from possibly the addition of a replacement EPROM interface for the synthesizer to achieve the required channels. If, however, you come across, say, a 'mid-band' VHF set (which transmits on 107MHz and receives on 139MHz), then unless you feel you're sufficiently competent, and have the required conversion information (or you're technically able to do this yourself), then leave it alone. "Can be converted to 2m" is again something I've often seen. It probably can, with a lot of work and circuit changes. Make sure the conversion information is available *before* you buy. Likewise, it often isn't worthwhile to convert an AM set to FM unless it's very cheap, as quite often the extra cost of components involved can outweigh the cost of an FM set in the first place. Having said that, there's a conversion planned for the MX293 to 2m FM for a forthcoming issue, as these sets *are* cheap *and* in plentiful supply! But forget a crystalled AM set unless you enjoy a challenge.

Crystals

When you order crystals for your set, ensure you state the final operation frequency and equipment type as well as the crystal frequency itself. Basically, the more information you can give the crystal supplier, the better the chance will be of your crystals being 'spot on' for the circuit capacitances etc. of the set. I've sometimes encountered crystals being up to half a channel out, with circuit mods needed, simply because the supplier thought they were for a different purpose.

Channel spacing

You'll find most VHF ex-PMR sets now, and some UHF sets, are fitted with IF filters for 12.5kHz channel spacing. With the possible move to 12.5kHz in amateur use, this may not be too much of a problem. You'll often find the 12.5kHz set operates acceptably for 2m and 70cm use at the moment - although you may find a bit of distortion on received speech peak. However it's usually an easy job to change the crystal and ceramic filters involved, component dealers such as Cirkit often sell suitable replacements. But watch the cost of these.

Future sets - VHF Marine?

So, what of the future? VHF and UHF sets will I'm sure be constantly available, but one type of equipment is, I believe, soon to also become available on the surplus market, albeit on a possibly 'individual' basis'. With the move towards GMDSS (Global Maritime Distress and Safety System), 156MHz marine portable and mobile radios are likely to become available as their users upgrade to sets equipped with the channel 70 digital capabilities required from 1999 for distress communication (i.e. help, I'm sinking!).

The vast majority of these sets are synthesised, and many are equipped with the facility of a number of 'private channels' to be programmed. One such handheld was used by myself at the Southamptn Boat Show on S16, chatting to the XYL G8IYA. I literally had my 'collar felt' by an RIS official who said "Oy, you can't do that". Of course, I could (and we're quite good friends now). 2m operation usually just means entering the required frequencies but most probably a re-tune down to the 145MHz range. Guess what I'll be carefully on for future ex-PMR conversion features in Ham Radio Today?

Prom Control Board For The Storno 5000

Graham Biggs G0OSF describes an EPROM circuit which will control either the Storno CQM 5114S or 5662S transceivers for multi-channel operation

This article describes a circuit which will control either the Storno 5114S (2m) or the Storno 5662S (70cm) FM Transceivers. Details of the EPROM contents given are correct for the 5114S conversion (HRT Nov '93) and for the 5662S conversion (HRT Mar '96). *If you missed the conversions and would like a copy, please see page 58 of this magazine for back issue and photocopy ordering information.*

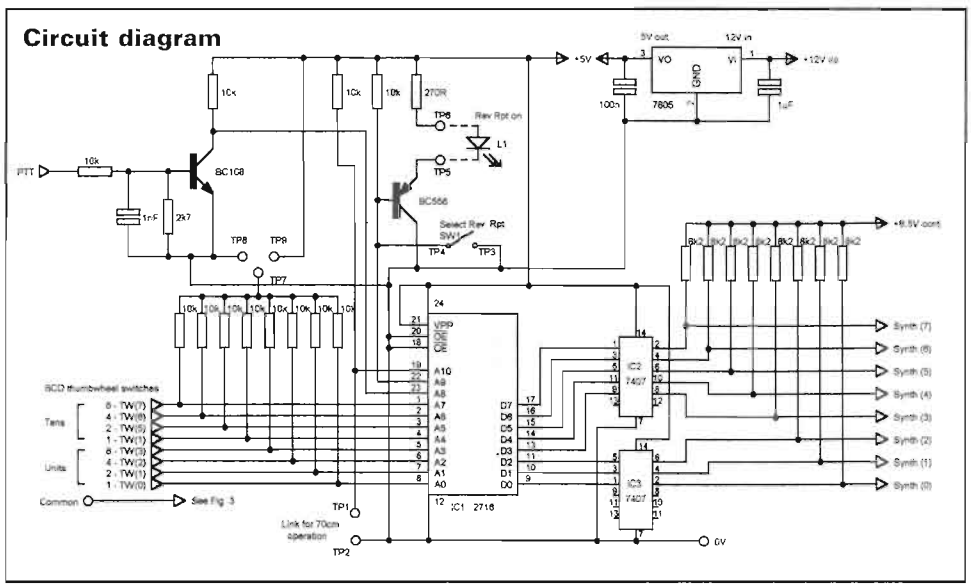
Description

The heart of the circuit is the 2716 EPROM. The two thumbwheel switches are connected to the right hand eight address bits to provide 100 different selections (0 to 99 using BCD switches). The next address bit is connected to the PTT, giving a logic '0' on receive and a logic '1' on transmit. The next address bit is connected to the 'reverse repeater' switch giving a '0' for reverse repeater shift 'on', and a '1' for 'off'. The left hand address bit is the 2m/70cm selection, '1' for 2m operation and '0' (link added) for 70cm. This gives a PROM memory map as shown in the accompanying table, the addresses are in hexadecimal format.

The start and stop addresses appear against the left hand side of each block. The block is selected by the left hand address bits and the thumbwheel switches select which address within the block. So, to program the PROM, you should first calculate what should be written to the synthesiser control bus for that selection, then program this into the appropriate location. However I have produced an EPROM, details in Table 1, which will give the FM channels as in the band plans. A full list of these channels is given in Tables 3 and 4. All the channels which have been allocated a number can be accessed by dialling that number on the thumbwheel switches.

Unfortunately the EPROM cannot be used to drive the MC145106 synthesiser directly. This is because it is connected to the 8.5V supply and the EPROM, which must operate from a 5V supply, will not supply a large enough voltage out to reliably control the synthesiser. Hence two 7407 open collector buffers are used. These allow the EPROM drive to use standard TTL levels whilst the outputs are pulled to the 8.5V supply. The buffers used in the 7407 have been chosen for ease of layout, which is why the pin connections look awkward.

Circuit diagram



Construction

A suggested PCB layout is shown. Once the board is etched or, if using Verobard or similar, check using a continuity meter for correct connections, check also for any unwanted shorts prior to component assembly. Refer to the component layout, and solder all the passive components (resistors and capacitors) in first, then if using IC sockets, solder these in next. Solder the two transistors into circuit. Place a resistance meter between the +5V rail and earth to make sure there is not a short. If PCB pins are to be used, solder these in position for the off-board connections.

Next solder the 7805 in position after first drilling out the bolt hole and bolting it to the PCB (it does not have to supply a great deal of current so will not get very hot). Apply +12V to the board and check that the +5V rail on the IC sockets is a nominal 5V. Now is the time to add the link between TP1 and TP2, if you want to use this with a CQM 5662S for 70cm operation. Connect the PCB to the thumbwheel switches and radio as shown in Figs 3 and 4, using ribbon cable or jumper wires. Remember to make the link as shown between TP7 and either TP8 or

Date: 26 Mar 96 20:14
Message-ID: <7628@GB7BLE>
From: G3YRH@GB7BLE
To: STORNO@GBR
Subject: Mod to HRT 5000 Mod
Path: GB7WRG!GB7BMX!GB7BLE

1252
735
614

From: G3YRH@GB7BLE.#17.GBR.EU
To : STORNO@GBR

G3YRH/TPK 1.82 Msg #:10 Date:26-03-96 Time:21:11Z

The following is a mod to the mod in April HRT hi.
First the 8k2 resistors on the outputs of the 7407
are not require as they are already in place on
the origanal board, as is the 5v regulator and the
PTT line.
Proceed as follows
all connections are to the existing prom holder so a
16 pin dil header is required.and one connection to plb
as in the mod.
This assumes you still have the original prom board.
The dil header plugs into the existing prom holder.
dil header pins

1	to synth (0) on new board
2	to synth (1) on new board
3	to synth (2) on new board
4	to synth (3) on new board
5	to synth (4) on new board
6	to synth (5) on new board
7	to synth (6) on new board
8	to earth on new board
9	to synth (7) on new board
10	not used
11	not used
12	not used
13	not used
14	to pin 23 on 2716 eprom new ptt switching
15	to earth on new board
16	+5 volts supply for new board

pin 5 on plb as in the article is the 8.5 volt
supply for the new board.
This mod means less components to buy hi.
The following compoments are no longer required
8 * 8k2 on the 7407 outputs, 7805 and 1uf and 100n.
bc108 2*10k 1uf and 2k7.
the rest of the mod as in the article.
brian g3yrh@gb7ble

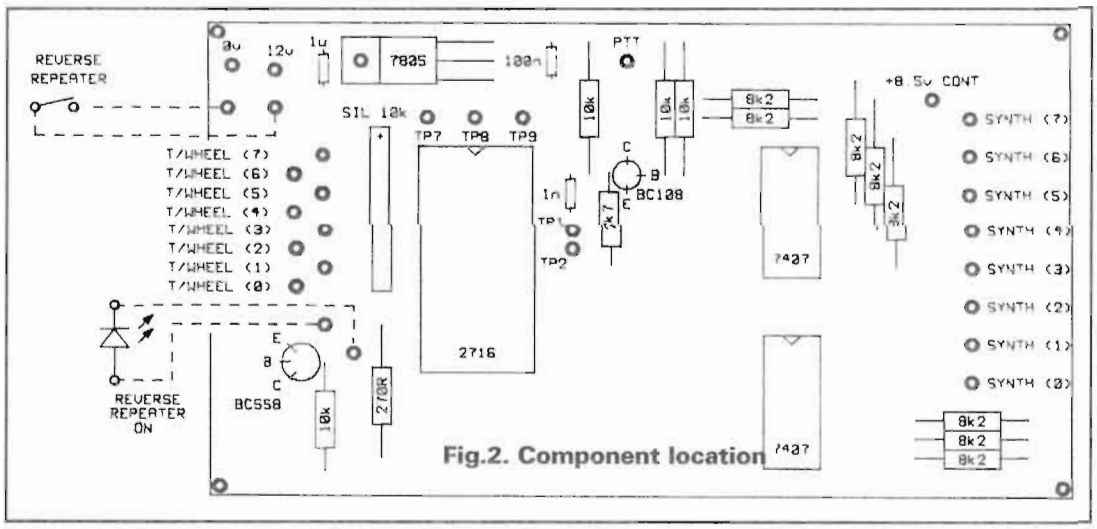


Fig.2. Component location

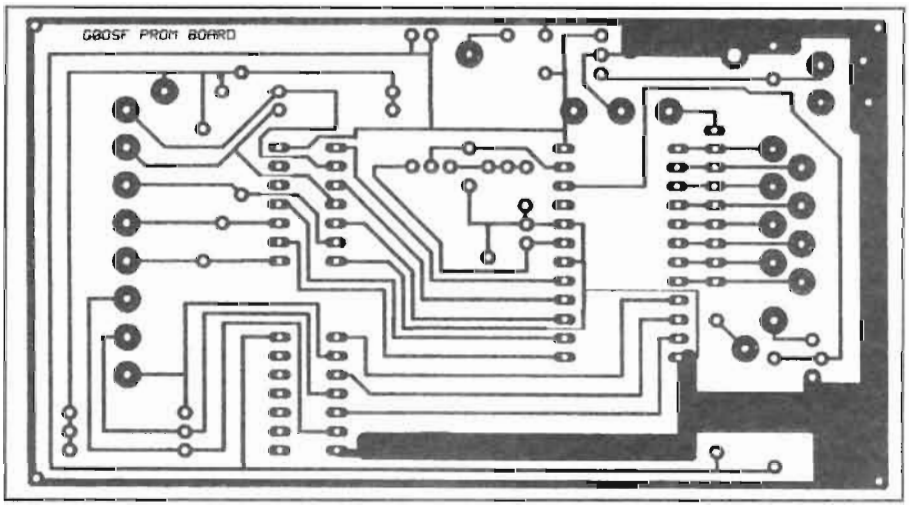
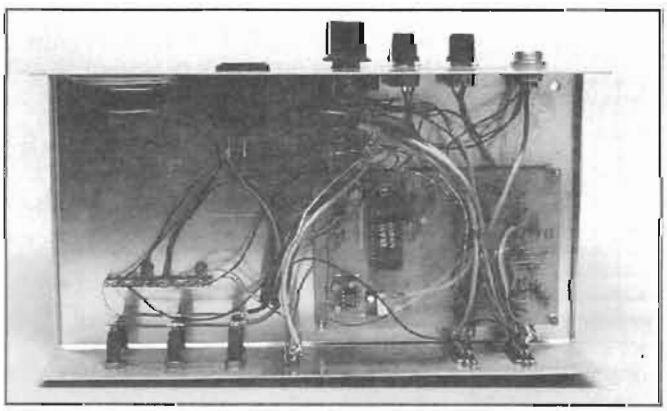


Fig.1. PCB layout, shown full size

TP9, depending upon the type of thumbwheel switch used. If you are unsure which type you have, then set the switch to zero, connect a meter between C (common) and each of the other four outputs (1, 2, 3 and 4). Check for continuity and if they are all connected then you have complementary outputs. If they are open circuit then you have standard outputs.

Now make the connections to the transceiver as shown in Fig 4. These connections may be soldered, but it would be wise to insulate them from each other to avoid shorts. Don't extend the pin height with thick or bulky wire, as these will foul when you replace the top lid of the set.



Testing

Switch the set on, and check that the board +12V and 5V are still OK. If all is well, switch off. Insert the three ICs and switch the transceiver back on. Set the thumbwheel switches as in Table 2 and check the outputs are as stated.

If some, or all of the channels are incorrect, check your connections to the thumbwheel switches. Ensure that the 'tens' switch is conected to synth 7 to 4 and the 'units' is connected to synth 3 to 0. If problems persist, check the thumbwheel outputs; with the switches set to 00 the outputs should be all digital 0's and increasing the channel number should give a straight binary count on the outputs. If you find you have the inverse of this, refer to Fig. 3 and choose the alternative switch configuration.

Once the synthesiser outputs are correct on receive, the transmitter output may be checked using a dummy Load. The EPROM was designed so that a valid channel is always selected provided it is connected correctly. The 'worst case' is that the calling channel is selected - all invalid inputs will give the calling channel. Check the transmitter frequency using a counter, a scanner or another FM set. If this is incorrect, check the EPROM inputs, and that the PTT line is connected correctly. Once all is OK you are ready to go on the air.

If you are unable to blow your own EPROM, you can send a blank 2716 to me in a suitable re-usable mailer, such as a Jiffy bag, with sufficient return postage, and I will blow it for you free of charge.

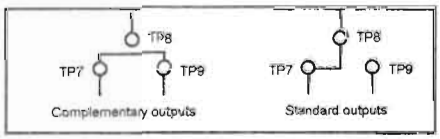
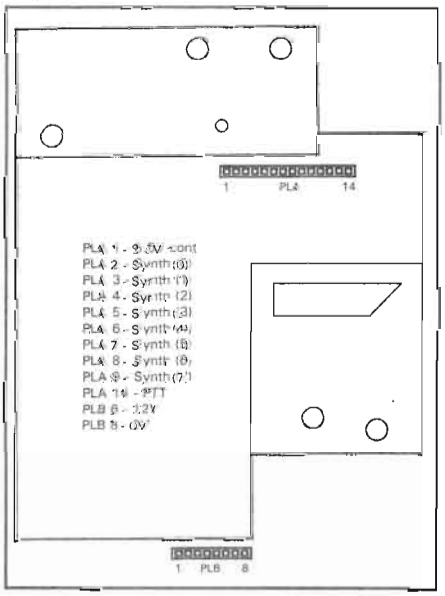


Fig.3 Thumbwheel switch connections

All queries regarding this project should be addressed to the author enclosing an SAE if a reply is required. Write to; Graham Biggs G0OSF, 16 Maple Drive, Newport, Isle of Wight PO30 5QP. Any reported updates to this article will be available on the 24hr Ham Radio Today Voicebank and Fax-back information line, Tel. 01703 263429.

Fig.4 Connections to radio



Parts list;

4 x 10k 1/4 W resistors
1 x 2k7 1/4 W resistor
1 x 270R 1/4 W resistor
8 x 8k2 1/4 W resistors
1 x 10k SIL array
1 x 1µF capacitor, tantalum or electrolytic
1 x 100nF capacitor, ceramic disc
1 x 1nF capacitor, ceramic
1 x EPROM 2716
2 x IC 7407
1 x BC108 transistor (or similar NPN)
1 x BC558 transistor (or similar PNP)
1 x 7805 voltage regulator
1 x LED (colour to suit own preference)
1 x SPST switch
2 x BCD thumbwheel switches

PROM Memory Map

Start - Stop Addresses	*Block*
0000-00FF	UHF/ Reverse Repeater on; Receive
0100-01FF	UHF/ Reverse Repeater on; Transmit
0200-02FF	UHF/ Reverse Repeater off; Receive
0300-03FF	UHF/ Reverse Repeater off; Transmit
0400-04FF	VHF/ Reverse Repeater on; Receive
0500-05FF	VHF/ Reverse Repeater on; Transmit
0600-06FF	VHF/ Reverse Repeater off; Receive
0700-07FF	VHF/ Reverse Repeater off, Transmit

Table 1

Address (Hex)Data (Hex)

0000 A8 AA AC AE B0 B2 B4 B6 B8 BA 50 50 50 50 50 50
0010 BC BE C0 C2 C4 C6 48 4A 4C 4E 50 50 50 50 50 50
0020 50 52 54 56 58 5A 5C 5E 60 62 50 50 50 50 50 50
0030 64 66 00 08 0A 0C 0E 10 50 50 50 50 50 50 50 50

Address 0040 to 00FF Data = 50

0100 28 2A 2C 2E 30 32 34 36 38 3A 50 50 50 50 50 50
0110 3C 3E 40 42 44 46 48 4A 4C 4E 50 50 50 50 50 50
0120 50 52 54 56 58 5A 5C 5E 60 62 50 50 50 50 50 50
0130 64 66 00 08 0A 0C 0E 10 50 50 50 50 50 50 50 50

Address 0140 to 01FF Data = 50

0200 28 2A 2C 2E 30 32 34 36 38 3A 50 50 50 50 50 50
0210 3C 3E 40 42 44 46 48 4A 4C 4E 50 50 50 50 50 50
0220 50 52 54 56 58 5A 5C 5E 60 62 50 50 50 50 50 50
0230 64 66 00 08 0A 0C 0E 10 50 50 50 50 50 50 50 50

Address 0240 to 02FF Data = 50

0300 A8 AA AC AE B0 B2 B4 B6 B8 BA 50 50 50 50 50 50
0310 BC BE C0 C2 C4 C6 48 4A 4C 4E 50 50 50 50 50 50
0320 50 52 54 56 58 5A 5C 5E 60 62 50 50 50 50 50 50
0330 64 66 00 08 0A 0C 0E 10 50 50 50 50 50 50 50 50

Address 0340 to 03FF Data = 50

0400 50 52 54 56 58 5A 5C 5E 60 62 78 78 78 78 78 78
0410 64 66 68 6A 6C 6E 70 72 74 76 78 78 78 78 78 78
0420 78 7A 7C 7E 42 40 3E 3C 3A 38 78 78 78 78 78 78
0430 36 34 32 30 2C 78 78 78 78 78 78 78 78 78 78 78

Address 0440 to 04FF Data = 78

0500 80 82 84 86 88 8A 8C 8E 62 60 78 78 78 78 78 78
0510 64 66 68 6A 6C 6E 70 72 74 76 78 78 78 78 78 78
0520 78 7A 7C 7E 42 40 3E 3C 3A 38 78 78 78 78 78 78
0530 36 34 32 30 2C 78 78 78 78 78 78 78 78 78 78 78

Address 0540 to 05FF Data = 78

0600 80 82 84 86 88 8A 8C 8E 60 62 78 78 78 78 78 78
0610 64 66 68 6A 6C 6E 70 72 74 76 78 78 78 78 78 78
0620 78 7A 7C 7E 42 40 3E 3C 3A 38 78 78 78 78 78 78
0630 36 34 32 30 2C 78 78 78 78 78 78 78 78 78 78 78

Address 0640 to 06FF Data = 78

0700 50 52 54 56 58 5A 5C 5E 60 62 78 78 78 78 78 78
0710 64 66 68 6A 6C 6E 70 72 74 76 78 78 78 78 78 78
0720 78 7A 7C 7E 42 40 3E 3C 3A 38 78 78 78 78 78 78
0730 36 34 32 30 2C 78 78 78 78 78 78 78 78 78 78 78

Address 0740 to 07FF Data = 78

All unused addresses are programmed with 50(VHF) or 78(UHF) which is the respective calling channel for the band. This ensures that there is always a valid channel selected. As may be seen from the Tables 3 and 4, repeater shift is automatic on the repeater channels. This design can cater for both normal and complemently output thumbwheel switches, see Fig. 3.

Table 2

	70cm								2m							
Output	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Thumb wheel																
00	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0
01	0	0	1	0	1	0	1	0	1	0	0	0	0	0	1	0
02	0	0	1	0	1	1	0	0	1	0	0	0	0	1	0	0
03	0	0	1	0	1	1	1	0	1	0	0	0	0	1	1	0
04	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0
05	0	0	1	1	0	0	1	0	1	0	0	0	1	0	1	0
06	0	0	1	1	0	1	0	0	1	0	0	0	1	1	0	0
07	0	0	1	1	0	1	1	0	1	0	0	0	1	1	1	0
08	0	0	1	1	1	0	0	0	0	1	1	0	0	0	0	0
09	0	0	1	1	1	0	1	0	0	1	1	0	0	0	1	0
10	0	0	1	1	1	1	0	0	0	1	1	0	0	1	0	0
11	0	0	1	1	1	1	1	0	0	1	1	0	0	1	1	0
12	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0
13	0	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0
14	0	1	0	0	0	1	0	0	1	1	0	1	1	0	0	0
15	0	1	0	0	0	1	1	0	0	1	1	0	1	1	1	0
16	0	1	0	0	1	0	0	0	0	1	1	1	0	0	0	0
17	0	1	0	0	1	0	1	0	0	1	1	1	0	0	1	0
18	0	1	0	0	1	1	0	0	0	1	1	1	0	1	0	0
19	0	1	0	0	1	1	1	0	0	1	1	1	0	1	1	0
20	0	1	0	1	0	0	0	0	0	1	1	1	1	0	0	0
21	0	1	0	1	0	0	1	0	0	1	1	1	1	0	1	0
22	0	1	0	1	0	1	0	0	0	1	1	1	1	1	0	0
23	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1	0
24	0	1	0	1	1	0	0	0	0	1	0	0	0	0	1	0
25	0	1	0	1	1	0	1	0	0	1	0	0	0	0	0	0
26	0	1	0	1	1	1	0	0	0	0	1	1	1	1	1	0
27	0	1	0	1	1	1	1	0	0	0	1	1	1	1	0	0
28	0	1	0	0	0	0	0	0	0	1	1	1	0	1	0	0
29	0	1	1	0	0	0	1	0	0	0	1	1	1	0	0	0
30	0	1	1	0	0	1	0	0	0	0	1	1	0	1	1	0
31	0	1	1	0	0	1	1	0	0	0	1	1	0	1	0	0
32	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0
33	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0
34	0	0	0	0	1	0	1	0	0	0	1	0	1	1	0	0
35	0	0	0	0	1	1	0	0	0	1	1	1	1	0	0	0
36	0	0	0	0	1	1	1	0	0	1	1	1	1	0	0	0
37	0	0	0	1	0	0	0	0	0	1	1	1	1	0	0	0

Table 3 - 70cm frequencies

Ch	Description	TX Freq. (MHz)	RX Freq. (MHz)
00	FM Repeater RBO	434.600	433.000
01	FM Repeater RB1	434.625	433.025
02	FM Repeater RB2	434.650	433.050
03	FM Repeater RB3	434.700	433.100
05	FM Repeater RB5	434.725	433.125
06	FM Repeater RB6	434.750	433.150
07	FM Repeater RB7	434.775	433.175
08	FM Repeater RB8	434.800	433.200
09	FM Repeater RB9	434.825	433.225
10	FM Repeater RB1O	434.850	433.250
11	FM Repeater RB11	434.875	433.275
12	FM Repeater RB12	434.900	433.300
13	FM Repeater RB13	434.925	433.325
14	FM Repeater RB14	434.950	433.175
15	FM Repeater RB15	434.975	433.375
16	FM Simplex SU16	433.400	as TX freq.
17	FM Simplex SU17	433.425	as TX
18	FM Simplex SU18	433.450	as TX
19	FM Simplex SU19	433.475	as TX
20	FM Simplex SU2O	433.500	as TX
21	FM Simplex SU21	433.525	as TX
22	FM Simplex SU22	433.550	as TX
23		433.575	as TX
24	RTTY (AFSK)	433.600	as TX
25	Packet	433.625	as TX
26	Packet	433.650	as TX
27	Packet	433.675	as TX
28	Raynet	433.700	as TX
29	Raynet	433.725	as TX
30	Raynet	433.750	as TX
31	Raynet	433.775	as TX
32	SSTV	432.500	as TX
33	RTTY (FSK)	432.600	as TX
34	Packet	432.625	as TX
35	Packet	432.650	as TX
36	Packet	432.675	as TX
37	Fax	432.700	as TX

Table 4 - 2 metre frequencies

Ch	Description	TX FREQ. (MHz)	RX FREQ (MHz)
00	Repeater Ch 0	145.000	145.600
01	Repeater Ch 1	145.025	145.625
02	Repeater Ch 2	145.050	145.650
03	Repeater Ch 3	145.075	145.675
04	Repeater Ch 4	145.100	145.700
05	Repeater Ch 5	145.125	145.725
06	Repeater Ch 6	145.150	145.750
07	Repeater Ch 7	145.175	145.775
08	Simplex Ch 8	145.200	as TX Freq.
09	Simplex Ch 9	145.225	as TX
10	Simplex Ch 10	145.250	as TX
11	Simplex Ch 11	145.275	as TX
12	Simplex Ch 12	145.300	as TX
13	Simplex Ch 13	145.325	as TX
14	Simplex Ch 14	145.350	as TX
15	Simplex Ch 15	145.375	as TX
16	Simplex Ch 16	145.400	as TX
17	Simplex Ch 17	145.425	as TX
18	Simplex Ch 18	145.450	as TX
19	Simplex Ch 19	145.475	as TX
20	Simplex Ch 20	145.500	as TX
21	Simplex Ch 21	145.525	as TX
22	Simplex Ch 22	145.550	as TX
23	Simplex Ch 23	145.575	as TX
24	Raynet	144.825	as TX
25	Raynet	144.800	as TX
26	Raynet	144.775	as TX
27	FSTV	144.750	as TX
28		144.725	as TX
29	FAX	144.700	as TX
30	Packet	144.675	as TX
31	Mailboxes	144.650	as TX
32	Packet	144.625	as TX
33	RTTY	144.600	as TX
34	SSTV	144.550	as TX

LETTERS

Letter of the month

Dear HRT,

I wish to respond to the letter in the February issue from Ray Oliver G3NDS. Back in January 1995 I myself had my car broken into and an Alinco DR-590 ripped out. I say ripped out because, as the saying goes "once bitten, twice shy". A number of years ago I had a portable stolen from a previous car. The Alinco was bolted rigid to the underside of the car's dashboard, which made it just about impossible to remove without tools, I thought. When I told this to the Loss Adjuster he said my insurance would cover my loss, how wrong he was.

Because I had attached the radio to my car, protecting it from easy theft, the insurance company told me it was part of the car's structure. But my car insurance company say it is a personal item, not part of the car. I wonder, who do I claim from if my engine is stolen, it's only bolted to the car, like my radio was.

I ask the question, why do we pay insurance companies extortionate amounts of money for nothing? The National Lottery costs less and pays out more often. I sympathise with Ray, and I am sure we are not the only two in this situation.

Steve Telford, G7HUJ

Editorial comment;

The thing here is to inform your insurance company of any such additions to your car. In fact many policies specifically ask whether the vehicle has been "modified from its original specification", the fitting of an expensive transceiver (or indeed car hi-fi) would be one such modification. You'll no doubt then find it's covered, or you'll at least be told if it isn't, thus letting you make other insurance arrangements. We know of one event where an amateur had three remote mounted ex-PMR sets, for 4m, 2m and 70cm, installed which were literally chained and padlocked into the car's boot - someone still tried to steal them!

Scientists speak out

Dear HRT,

I must write in to fully support Dr. G. Brown's comments in the February 1996 Ham Radio Today. It was the first article I have ever read from a scientist's point of view rather than a communicator's. This is probably because we are such a minority within the hobby.

From the scientific point of view I would like to see a special class of licence for research into narrow band modes and their ionospheric propagation, say 1kHz on all HF bands. This can be divided into 50 or more channels with good crystal and computer filters available these days. Narrow band should give us a 20dB improvement in S/N ratio over old-fashioned SSB. It should be noted that most band noise and static is wideband and therefore virtually identical at a frequency of10Hz away, therefore can be balanced out leaving only the wanted signal. This could lead to noisy bands becoming virtually silent, which would be of benefit to any amateur who has ever worked DX, as well as easing congestion on the bands. Commercial users would use NB and stop pestering the RA for more of our precious band space.

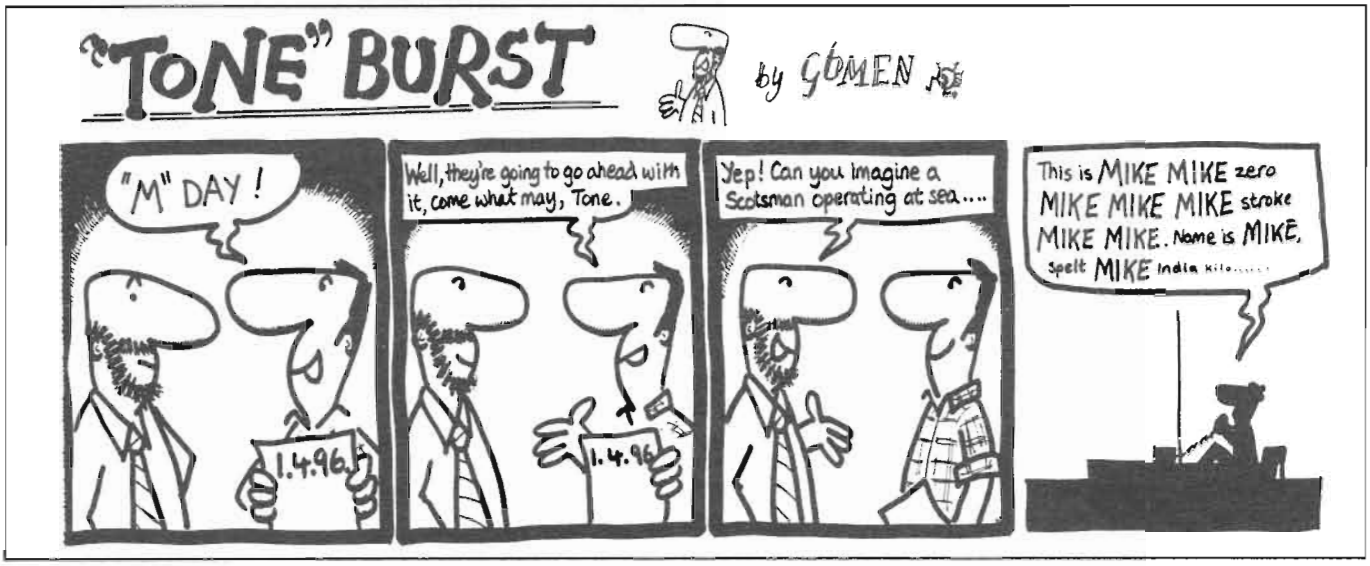
I hope the 'A' licensees will not continue to keep their heads in the sand over technology, because there is a potential time bomb ticking away in the form of the legalization of VLF for 'A' licensees as well as cavemen. This is to be a special band to be given to amateurs, so they can improve the existing equipment which will help the cave rescue services save lives.

Given this objective and the possibility of a fatality occurring because the scientists were not allowed to experiment on the band, I think this is an issue that should be taken most seriously by the powers that be. It puts our hobby's petty politics into true perspective.

A.E. Davis GW6JLH

£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 chris@radshack.demon.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



Filters

Dear HRT,

I would like to commend the courage of Dr. George Brown, for expressing so simply and forthrightly, what many of us feel to be right, but dare not say for fear of being howled down.

I became a radio ham through a love of HF. I value Morse and have had some very halting QSOs on that mode on VHF, including satellites, and including some nice DX. However, I am one of the people cursed with Morse blindness, and because of my clumsiness and inability, despite great efforts and much off-air practice, I gave up using CW out of consideration to the stations who had to put up with my constant errors and corrections.

As things stand, HF is forbidden to me at my own station. If that is to remain so, I am prepared to bear it. I do not however feel entitled to claim a place on HF unless I have a constructive suggestion for an alternative 'route' there. The Morse test *has* fulfilled one useful function, that of being a 'filter', allowing a trickle of new entrants to the HF bands, and thereby helping to reduce congestion.

A filter *should* exist, but Morse code should *not* be the sole route now, as it is in many ways obsolete (I'm sorry, but it *is*, however much I like to hear it used!). Perhaps the only fair substitute, or indeed a parallel if slower route, is to allow people to progress onto the HF bands, one at a time, over a period of years, starting from the date the person is first licensed.

I hope the amateur community and the authorities will give this suggestion fair consideration.

Paul Thompson, G6MEN

Free licence?

Dear HRT,

I have little doubt that many will wish to bring G4VBB back into the real world, away from the thoughts of 'Smith Square'. With one in five OAP's on an occupational pension, disabled living in a sparse existence, not forgetting the unemployed, the hobby offers a lifeline to many, of limited means.

I believe the licence should be free to all, as in the USA. Nobody would deny that they do well, with extended bands etc. This brings forward another point, that 'old chestnut' Morse. Until the US do something, its pointless us blowing off steam. For my part, I would favour the present speed requirement being reduced progressively over time, whilst enhancing technical requirements.

Surely the big plus point to our hobby, is that we meet and speak to such a diverse group of people. How much poorer it would be with just Yuppie's and Fat Cats.

George Woods, G3LPT

Regulation by pricing

Dear HRT,

I must congratulate Mr G.P. Hamblin G4VBB, February Ham Radio Today. He has found a way to regulate the bands and also amateur radio as a hobby, price many of us out of the hobby altogether, now why didn't more of us think of that, leave the hobby in the hands of the rich and no more problems. I must admit he is right in *one* thing, radio and amateur radio is important, most amateurs know that, that's why many amateurs put so much into the hobby. We don't need Mr Hamblin's ridiculous proposals to be committed to amateur radio. His "realistic" price of a minimum £100+ licence fee and additional fees for each and every bands to be used, is *totally unrealistic*. For myself and many present and future amateurs, it would be the end of amateur radio, as for commercial and military radio theirs is a business, ours is a hobby, no comparison. Many amateurs have limited funds and have difficulty setting up stations, having to use secondhand equipment because they cannot afford new. Mr Hamblin is obviously in the well heeled bracket, so no problem to him, but this hobby is for all, rich or poor, its not the rich that make this hobby interesting as he should well know. A 85+% increase in licence fees, let alone having to pay for each additional band, would not do amateur radio much good and probably restrict many amateurs on the bands they could use. We cannot allow the hobby to become a two-tier system, the 'haves' and 'have nots', no one should be restricted on how many bands he/she can use because of low income. If that happens, then to me, amateur radio ceases to be a hobby

Tom Waters, G0GQJ/N8WHF

From My Notebook

Geoff Arnold G3GSR discusses the advancement of digital electronics in amateur radio and relates an amusing tale of an 'intermittent' fault

Over the past few decades, digital electronics have played an ever-increasing role in radio communications. I'm not quite sure what the first step on the way was, but so far as I was concerned, it started off with tuned frequency readouts. At first, these relied on using external counters - the circuitry was too large and too electrically noisy to think about fitting it inside a radio set.

It was not long, though, before advancing integrated circuit technology made it possible to fit a complete readout inside a receiver, in a screening box, along with the necessary filtering to keep the noise out of the RF circuitry. This started off with large and heavy professional communications receivers, but by the mid-1970s the facility had even reached the amateur radio market, for example in the little add-in unit which could replace the mechanical readout of kHz in the Yaesu FRG-7. That particular unit was quite an achievement on two counts. First, it had to cope with the fact that the kHz local oscillator in Wadley-loop systems tunes 'back-to-front', in other words when you tune up the band, the oscillator frequency moves lower. Secondly, it had to be crammed into the space vacated by the mechanical drum-scale mechanism.

But I digress! The digital revolution has now reached the position where every stage of the radio circuit, apart from the actual transmission path through the ether, can be based upon what are really no more than thousands and thousands of tiny on/off switches. Most of us (and especially those approaching old-timer status like myself), cannot begin to understand in detail what goes on inside the increasingly complex ICs now being fitted into every professional and consumer electronic product. However, we do need at least to appreciate the basic requirements of those multi-legged chips in their interface with the outside world.

Supplies

At one time, once the early technologies such as RTL (resistor-transistor logic) and DTL (diode-transistor logic) were out of the way, the digital world settled down to the original 7400-series TTL (transistor-transistor logic), where everything worked from a nominal +5-volt supply. According to the maker's specifications, the supply actually had to lie between 4.75 and 5.25 volts.

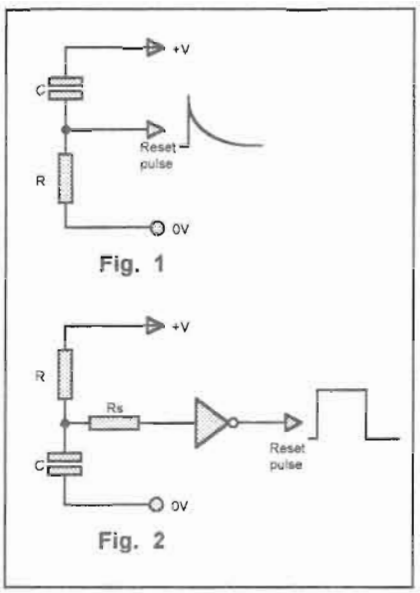
This didn't last for long, though, and for a variety of reasons all manner of other logic families, each with their own particular power supply requirements, started to appear. I am no longer involved in the world of logic circuitry (other than as a user of the end products), and the sort of ICs which I was designing with back at the beginning of the 1970s have long since ceased to exist.

From reading the technical press, I get the impression now that some new logic family or variant comes out of the semiconductor houses design labs every few months nowadays. Each seems to have its own supply requirements, and permissible logic input levels - what the chip will recognise reliably as a '1' or a '0' - and I don't propose to even try to discuss them here. You'll need to go to the manufacturer's or supplier's catalogues for the particular IC family you are concerned with, in order to get that information.

Inputs and outputs

I've already mentioned the requirement to keep signal input levels within acceptable limits, and of course that will also apply to outputs, for generally an output will simply be providing the input for another stage, which will have its own acceptable input range. In talking about inputs, these are not just the straightforward signal inputs, but also those which have the job of setting or resetting a switch, or clocking or strobing a more complex circuit.

In logic terms, a switch is a binary element - it has two states - which may either be a monostable or a bistable. A monostable, as its name implies, has one stable resting state, and flips over to its opposite state for a given period after a trigger signal is applied, then returns to its rest state. The bistable, on other hand, has two stable states, and will happily sit in one or the other until a trigger pulse comes along to cause it to change to the other state. In other words it remembers the last instruction given to it.



Complex logic circuits are usually based on strings of bistable switches, and it is obviously essential to make sure that each and every one has taken up the correct state to start with, when the circuit is first switched on. Every single bistable will have a slightly different speed of operation, even though the differences may only amount to nanoseconds, so when power is first applied to the circuit, there is no way of knowing what state they will take up. Even for a single bistable, there's a theoretical evens chance of it assuming either of its states at switch-on.

The circuit designer takes care of this by arranging for a reset pulse to be applied automatically to the bistables immediately after power has been switched on. There are different ways of doing this, but in general they make use of the time delay inherent in a capacitor charging via a resistor.

Taking the simplest case first, looking at Figure 1, at the moment of switch-on, C carries no charge. The top plate of C is taken up to V+, and because the voltage across a capacitor cannot change instantaneously, the bottom plate will follow suit. Capacitor C will then charge through resistor R, at a rate dependant on their values (time-constant), and the voltage at the tapping marked 'Reset pulse' will

decay to zero.

Because the decay naturally follows an exponential law, the end of the reset pulse is not well-defined, and the circuitry being reset may not like this very much. An alternative is to put a Schmitt trigger inverter into the circuit, as shown in Figure 2, to sharpen up the reset pulse.

Because of the inversion within the gate, the capacitor and resistor have to be transposed. The gate input is at zero volts at the moment of switch-on, but climbs towards V+ as C charges through R. At some point, the switching threshold of the inverter will be reached and its output, which was at V+, falls cleanly to zero. The resistor Rs (typically 10 kilohms) is there to limit the input current to the inverter to a safe value when the steady state (C charged fully to V+) is reached. The duration of the output pulse is approximately 0.7CR, and for typical values of 1 megohm and 1 microfarad, would be 0.7 second.

Slow changes

Digital circuits in general do not like slowly changing inputs, and it is for this reason that the Schmitt trigger circuit mentioned above is often used. A trigger circuit is simply an electronic switch with built-in hysteresis, which means that once it has changed over from one state to another as a result of a rising input level, it requires that level to be taken substantially lower before it will switch back again. The same applies if the input level was falling before the switch-over.

The effect of a slowly changing input can be quite catastrophic in some circuits. Back in the 1960s, when I was working in marine radio and electronics, it was decided to install a juke-box in a 'young peoples' room in all the passenger ships in our fleet. Because the electricity supply on most of the ships was 220V DC, and the juke boxes required 240V AC, it was necessary to fit static inverters to drive them. Static inverters were a very newfangled thing at the time - a couple of years earlier we would have been using motor-alternator sets for the job.

The juke-boxes would consume up to 700 to 800 watts with all their amplifiers, motors and lighting, and so a 1kW static inverter was selected. All went well, with the equipment surviving tropical temperatures, dud coins, having fruit juice and squashes poured into the coin slots, even having the reject button pushed right into the inside of the machine with the aid of brute force and a stiletto heel! Then, we started to have problems with the static inverters, which would occasionally self-destruct, but luckily always shortly after the ship reached home port.

After investigations by the manufacturers, ship and shore staffs, etc., it was eventually discovered that the failures happened when the ship s engineers decided to shut down the main generators by the time-honoured method of turning off their steam supply and just letting them run down to a stop. When the supply dropped to around 170 volts, the two-transistor astable oscillator driving the output SCRs simply stopped oscillating, leaving one of the SCRs passing full DC current through its half of the inverter transformer. Adding a little voltage-sensing circuit, which closed down the unit when the mains input went below 200 volts, quickly did the trick

and vice versa!

It was no help in that case, because we didn't know exactly when the engineers had turned off the steam, but sometimes you may get a clue as to the cause of a problem by observing how long it is after a given event, before the fault occurs. To close this month, I'll give you a couple of examples, both of them from the valve era, although the second could just as well happen today.

The first relates to an echo-sounder equipment, which used a display consisting of a neon tube mounted on the end of a swiftly rotating arm, which flashed to indicate the depth of water under a ship's keel, read off from an adjoining circular scale. The driving motor, arm, and scale, plus a single triode valve DC amplifier, were mounted on a hinged door, with a cable-form connecting them to the rest of the circuitry in the back of the case. One of these units fitted in a ship I sailed on, developed an intermittent fault which caused the neon to stop flashing.

Faults which come and go are always the hardest to track down, but after opening and closing the front door of the unit a few times whilst checking operation, this one changed its characteristics slightly - when the door was open everything worked perfectly, but when it was closed the neon flashes faded out.

It was eventually realised that the disappearance and reappearance of the flashes took around 25 to 30 seconds each time, and this pointed to the heater circuit of the DC amplifier valve. As you've probably guessed by now, there was a broken wire in the cable-form, which was being flexed by opening and closing the door, so that sometimes the valve lost its heater supply, taking around 30 seconds to cool down and lose emission from the cathode, and another 30 seconds to warm up again when the supply was restored.

My last 'time-delay' fault relates to a problem with a public address and sound entertainment system fitted in a small passenger ship which had been bought from its previous owner. It needed quite a bit of work done to it, such as replacing every single electrolytic capacitor in the pre-amplifier and amplifiers, to restore the bass response to something reasonable. However, the particular fault I want to describe was a report from the ship's staff of occasional 'motor-boating' instability (a sort of 'putt-putt-putt' noise) when playing music tapes on the big reel-to-reel recorder.

While the ship was in port between voyages, we started testing for this, and indeed we could get the fault to appear occasionally. However, it seemed totally random, and our first clue came when it was noticed that it only seemed to affect some tapes, usually those on 8-1/4in or 10-1/2in reels. These were most unusual for pre-recorded music tapes of the time, which normally came on 7-inch reels, and that ought to have aroused our suspicions earlier.

It finally dawned on us that on any given tape, the fault always appeared at the same time, and we realised the distortion was actually on the tapes. We later discovered that virtually all the music tapes on board, all of which had come with the ship, were not in fact pre-recorded, but had been produced by a relative of the previous owners who was something of a hi-fi buff. He had recorded them off-air, via a tuner or receiver which was intermittently motor-boating!

The moral of this story is, that should you encounter an intermittent fault, it is always worth noting down how long after switch-on, change of mode, or whatever, that it took to appear. You could save yourself a lot of time!

QRP corner

Dick Pascoe G0BPS suggests some new QRP abbreviations, and shows how to add an RX and TX meter to your QRP rig

In my last column I discussed the concept of minimalism. It appears that I only just scratched the surface of this in the field of amateur radio and low power. QRP, like most aspects of the hobby, has a wide variety of interests which are often followed with a strength of feeling not found with the QRO operator. Perhaps it is because we have to work harder for our contacts that we get greater pleasure from it. Much like the high handicap golfer like myself, If I go round a course hitting the ball one hundred times I must get 25% more pleasure from the game than the chap who goes round in eighty, Yes?

With modern day components requiring an eyeglass to determine the difference between a resistor and a capacitor, all transceivers now seem to be able to be condensed into a matchbox. Compare the elderly KW2000 from KW Communications that was 100W, amateur bands only and big, to the latest IC706, 100W, general coverage, with 2m *and* 6m transceive also built in. And it is only the same size as an early 2m box. Where will we be in ten years time? One amateur I know has a single band transceiver which he built, it is in a box the same size as the KW2000. Where have all the valves gone?

Because of this trend in shrinking everything in sight I offer the following for your interest and comments.

A; *QRP*, as we all know and love. 5W CW, 10W SSB

B; *QRPp*, Power levels of under one watt, either CW or SSB. Only for the truly masochistic.

C; *QRPm*, For those who always want to use less power than the other operator, the true minimalistic approach. You must be able to calculate the losses in your system to at least 0.1dB

D; *QRPe*, for those who have finely tuned their systems so that the total loss is less than 0.1dB.

E; *QRPf*, For those operating in the field or portable, less brownie points scored if the sun is shining, greater scores if it is blowing a gale.

F; *QRPl*, For those members of the QRP-L email list.

G; *QRPx*, For those who are involved in QRP foxhunting.

H; *QRPh*, for those who are using totally home made equipment

J; *QRPk*, For those who are using kit transceivers.

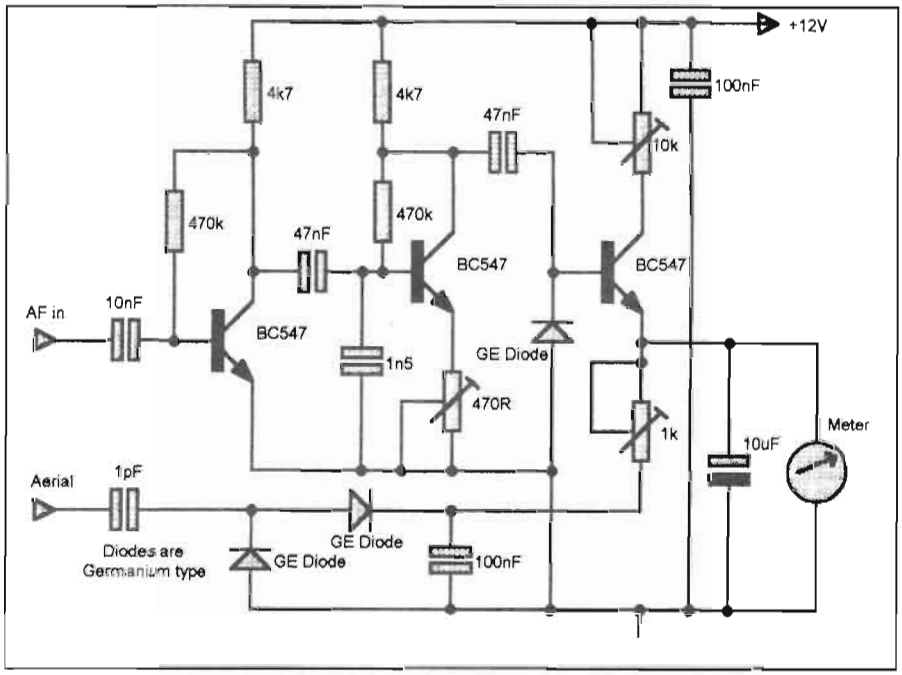
K; *QRPd*, for those who don't have a stable VFO.

There must be many more, any ideas. Please let me know of any more?

Wherever you turn in the amateur field the talk will inevitably turn to aerials at some time. I have often heard the chat about the random length of wire that works well even though it is not resonant on any frequency! Needless to say that phrase should be qualified, the aerial, the random wire aerial is not resonant on any amateur band. Any length of wire will be resonant at a frequency which may be unknown, but a grid dip oscillator will tell us.

Another story recently reached me about a gift of some elderly equipment. The owner was happy to give the equipment away, but there was a proviso. When the recipient had finished with it he was to give it to another who had need of it.

This seems to sum up many amateurs, especially those I have found in the QRP world. We will part with the shirts from our backs for another amateur, but they must pass it on when they have done with it to someone else who may have need of it. Have you seen this happen before?



Combined S meter and relative output meter

Add-on TX/RX meter

Many circuits have appeared over the years for various types of rigs, both receivers and transmitters. Most of these simple rigs will not have an 'S' meter (relative signal meter), the following circuit is from OK1FVD which was sent to me recently. (It's a relative TX RF power meter and RX audio-derived S-meter - Tech Ed). Almost any NPN transistors can be used, the original specified is BC547. The diodes should be germanium type. Build it and try it and have some fun, let me know you get on.

Winter Sports

As I sit and write this, the G-QRP club's 'Winter Sports' are in full swing. I found that (when I was able to

operate!) the bands were fairly quiet, without the normal amount of activity that I would expect. I worked nothing of note, but I expect that several did. Frank G3YCC managed to work over in the Easternmost Isles, Barbados. The Winter Sports are not a contest and should not be treated as such. But it does get to be huge fun, as most of the QRP world tries to get on the air at the same time. The bands tend to be busy with QRPers trying to get as many contacts as possible and have a chat at the same time.

One horrible thing that came to light, yet again was the data on 10.106MHz, the QRP centre on the band. I am told that this is a commercial station running some kilowatts. G3YCC in the north of England reports it at 59+40dB, in the south it is much less. In Texas it is often heard strongly too. Has anyone got more information? *(It's listed as an 75 baud unidentified teleprinter - Tech Ed).* We don't want to change frequency but may have to.

Dates for your diary

Some dates of forthcoming events in 1996;
May 7th to 10th, Yeovil Fun Run. *May 18/19th* Yeovil QRP Convention - meet the Ham Radio Today Editors. *June 17th* IARU QRP contest & VHF Contest (listen for G0BPS). *July 20/21st* AGCW DL QRP Contest. *Sept 27/28/29* Europe for CW. *Oct 12th* Rochdale Mini Convention.

The previously published date for the Rochdale mini convention of the 19th October 1996 is incorrect. The Leicester Exhibition is on this day so to avoid clashing again our convention has been moved.

George G3RJV, myself G0BPS with Roy W7EL (of aerial computer program fame) will be mobile in Europe, France, Belgium, Luxembourg, Germany, and the Czech Republic during the period June 25th until July 14th whilst travelling to the Friedrichshafen rally. I'm also hoping to visit Petre OK1CZ for a couple of days. We shall be operating with a TS50 into a Texas Bugcatcher, mostly on 20m and 40m on the QRP frequencies, CW and SSB. Dayton also calls and each of us will also be in Ohio in mid May for this hamfest. We shall try to get on the air from the hotel, but there is always a fight for the rig and the key.

More miles per watt

Many low power enthusiasts strive to make long distance contacts to attain high 'miles per watt' scores. It now appears that one group have attained 782,000,000,000 miles per watt.

No it was *not* on 20m or even 15m, it was on 2.304GHz with the transmitter and the receiver spaced just 10m apart! Not all DX is worked on the HF or VHF bands! Edwin PB0AOL and I will be experimenting with a few hundred milliwatts on 23cm in the summer, we should work Arnheim to Folkestone.

A quick word of warning to 'QRP Plus' rig owners, from AA1IK; "I plugged the power cord into the back of the QRP+ and had the male plug a little crooked and touched the side of the power plug on the rig, *poof*, no more receiver". The answer is a diode in the power line, or change the plug he says.

The IC-706 has been with us for several months now, providing strong competition to the Alinco and Kenwood rigs. Have any readers knowledge of this radio at QRP levels? Details of any mods or changes would be appreciated.

News, views and reports to me please via the Editor, or direct via: Packet to GB7RMS, post to Seaview, Crete Road East, Folkestone CT18 7EG. or Email to

VHF/UHF Message

Geoff Brown GJ4ICD reports on fantastic Sporadic E events over winter and says there's no April fool involved!

December 23rd 1995 was one of those very interesting days, Multi-hop 'ES' were prevalent in Australia, and single hop 'ES' was recorded in Europe and the USA.

On the 24th there was an aurora, SM's worked SP's on 144MHz and PA0BFM worked GM on 50MHz, and again there was another sporadic 'E' opening on *both* sides of the 'pond'! On the 25th, more reports of Sporadic 'E', but on the 26/27th reports of 144MHz in the USA!!

Australian 50MHz activity

Steve VK3OT sent the following information about what's happening in Australia;

"We still have 46.172 and 46.240 high power on the air. The Australian DMEA services have now been terminated on 200 MHz so the way is clear to expand Channel 11 and 12 (or 9A and 12). So there is room for the 0's to shift, but I don't see any evidence that they will.

The 57.250 services have increased power locally to 150,000W but it is 70 miles so I don't hear any signals. VK5NC, VK5EE are in a different boat though and have had to severely limit their operating times. TVI is the biggest bugbear as always with us all.

We have the path test under way with ZS6WB and ZS6PJL but no indications across the pole yet this year. Had a large burst of solar noise on Dec 9th at 0240z for 4 minutes which has given the band a real suppressant. We have also been working a few JA's in the 0400z slot up to 0700z. VK6 has been coming in each morning on local E's and I am told they are putting a beacon on 50.306 beaming at ZS6.

We are listening for the ZS8 beacon (would you believe on 50.200MHz de Geoff) and maybe the VK0 beacon relocated at Davis Base also on 50.200MHz!

There are a number of large arrays here now but VK8ZLX has gone QRT from Alice Springs and I never hear what VK6PA and VK6JQ are doing. The VK6 Perth boys are active and VK6AS is running 400W. Beacons are still on 50.053 and 28.253 MHz".

On the 18th December, Steve reported the following: 48.250 and 48.2396MHz video signals were received in southern and eastern Australia from approx 1000z to 1100z.

The beam heading was 300 degrees from QF12. 48.2507 was very strong at S9+, 48.2396 was weaker at S9.

Video buzz was evident and a spattering of sound on 53.750 was audible at 1030z. The video was received in VK1, VK3 and VK5 area and pronounced backscatter was evident on 46.172 video from the west. No amateur signals were received except from VK/ZL.

So where was the 48MHz video coming from at this time of the cycle? Very interesting! It seems to have been via multi-hop sporadic 'E' from somewhere around 9M/9V at the beam heading quoted.

As the header states, "December 23rd was one of those very interesting days".

Don VK6HK in Perth sent a report of what had been happening on 6m. Here's a report for the 22nd/23rd December, compare this with reports from Europe and the USA!

22/12/95:0059 VK3RMV beacon, 0348 VK5BC, 0751 VK3AMX, 0736 VK5ZBK, 0847 VK3AMZ, 0856 VK3ATQ.

23/12/95:0800_1000 TV Mt Gambier (VK5) 100kW 57.250 9+, 0821 VK5ZDS/P, 1037 TV Toowoomba (VK4) 100kW 46.172 9+.

African 50MHz activity

Well-known DXers YU1AU and YU1AD were active during October from the club station of 3V8BB,

It was nice to see the first QSO's from Tunisia on 50MHz. SM7AED was the first station who worked 3V8, followed by PA0 stations.

On the 25th, I managed a very quick Meteor Scatter contact with the station at a distance of 1693km, just 44km short of the IARU R1 50MHz Meteor Scatter distance record! Well I thought it was, but on checking through a few log books I discovered that back in 1990 I worked OH3MF (KP20) via MS at a distance of 2099km.

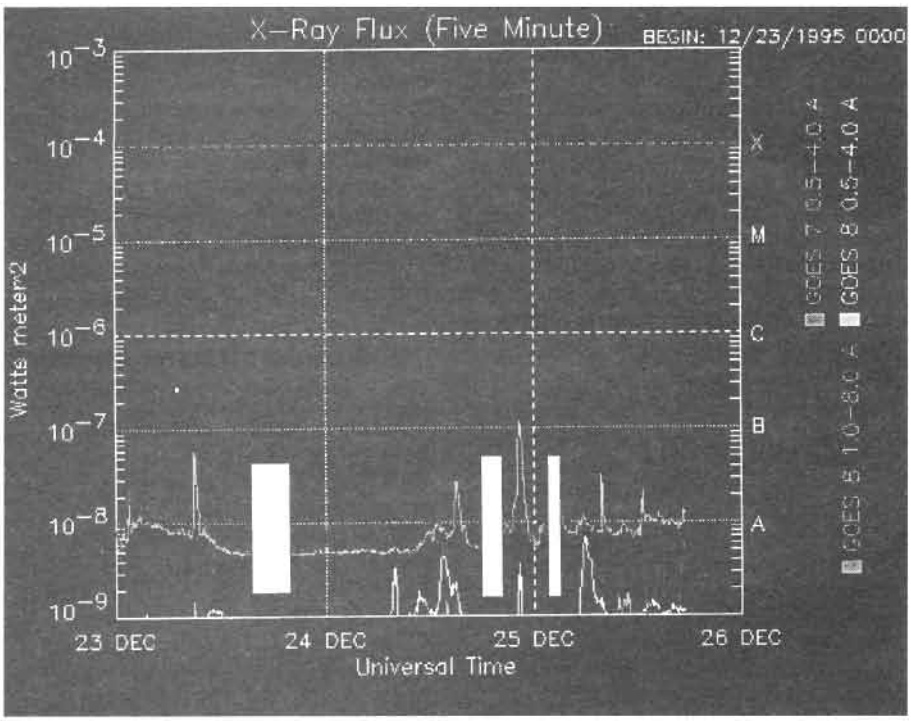
On October 26th, quite a few G/GW stations also worked 3V8BB, but this time it was via 'ES'. Stations known to have made the grade were G4JCC (Hayling Island), G3KOX (Welwyn), G3WOS (Hampshire), G3HBR (Bucks), G4UPS (Devon), G3SYC (Yorks), G4CCZ (Surrey) and maybe a few more. Interestingly the opening was short but very widespread, as, the distance between G3SYC and G4JCC is about 350km. Well done to all concerned.

European 50MHz activity

December brought the usual winter 'ES' openings, there were several minor openings and a few major openings on the 23rd, 24th and 25th.

The 23rd seemed the best with the band being open for over three hours. Listed here are just a few of the reports;

GJ7RWT worked SP in KO12 (rare!).
G4ASR: 50105.0 SP4MPB 559 KO03 to IO81MX,
G4ASR: 50024.0 SP5SIX 589 KO020F
SP4CHY: 50129.0 F1BBK
IK0FTA: 50120.0 G6ZQI
IK5QGO_9: 50125.0 G4MQK
SP4CHY: 50110.0 F1ASX
PA0ION: 50110.0 S59F
IK1EGC: 50110.0 GM0NAS
DL4MDQ: 50105.0 G4BWP



DF8AA_7: 50105.0 G4IGO
IK1EGC: 50070.0 SK3SIX
G3IBI: 50110.0 S59F
G4IFX: 50124.0 OE9DGV

Quite a widespread affair from Scotland to Italy and Somerset to Germany, openings also occurred in the USA (see later news).

On the afternoon of the 24th December, an aurora occurred, and shortly later another Sporadic 'E' opening happened in both Europe and the USA. Looking at Fig.1, there does seem to be a pattern, on the 23rd several hours after the intense rise of X_Ray flux levels (about 1000z) the first large Sporadic 'E' occurred.

On the 24th between 1700 and 1830z, another opening occurred in Europe and the USA, and finally on the 25th in the early hours the USA had another event (0130z).
All these openings transpired after X_Ray flux levels increased, just as we would expect for auroras. It's also worth noting that the Electron flux went high and stayed so during the peak openings on 25th/26th.

USA 50MHz activity

As mentioned above, the USA also had an opening on 50MHz on the same day as Europe. This is very useful information as it puts pay to many ideas or theories on how Sporadic E is formed.

Many have speculated for years that Sporadic E is associated with wind shearing. If this were true, then why would we have openings on two continents split by at least 4000km? Surely wind shearing is not that widespread! These repeat openings have been monitored many times, like there have been openings in Japan, then several hours later in Europe and finally the openings continued in the USA.

To show this, here is a shortened list for the 23rd December to compare with the above;
50125.0 KD4MZM 2315Z EL87 into EN61
50141.0 W2VDI 2304Z EL86 into FN13
50125.0 KE4LBQ 2235z 50125.0 KB4LBQ 2226z FLA>FN04
50135.5 W2VDI 2216z EL86>EN60
50125.0 KE4DQX 2208z FM16>EL49
50125.0 KE4MNS 2207z FM16>EL49
50125.0 KE4DQX 23 Dec1995 2159z VA. FM16>EM40
50125.0 KD4MZM 2315z EL87 into EN61
50125.0 K1WW 2311z FM15>EL49 N.C.
50141.0 W2VDI 2304z EL86 into FN13
50125.0 KE4LBQ 2235z 50125.0 KB4LBQ 2226z FLA>FN04
50135.5 W2VDI 2216z EL86>EN60
50125.0 KE4DQX 2208z FM16>EL49
50125.0 KE4MNS 2207z FM16>EL49
50125.0 KE4DQX 2159z VA. FM16>EM40

Nearly an exact copy of the above opening also occurred on the 24th December, similar on the 25th. But the best was yet to come.

I received a report from Dave N7DB as follows, "Yikes, I did not expect to file this report!" A few minutes ago, KE7WH (CN86) worked N0IPL (DM76) on 2m at 0127z. I could see the MUF going up (Denver CH4, Q5 colour pix) and noted some co_channel with our local CH6. I could not hear N0IPL at this QTH when WH had the QSO, so the cloud is a bit small. Will keep an ear on 144.200 +/_ 20. CUL de Dave, N7DB. Another 144MHz opening occurred on the 26th, this was much more widespread.

Conclusions

There is no doubt that collating Sporadic 'E' information from each continent reveals some interesting results, especially when openings occur from continent to continent as daylight progresses. These observations hold some answers that may have been overlooked, for instance, this pattern of openings is exactly like an F2 pattern of openings. During sunspot maximum, openings occur from east to west as daylight progresses (the same as HF propagation) and the MUF builds! It appears at solar minimum that sporadic 'E' is following similar guidelines. This is something that will be monitored very closely now that many reports are fed onto the Internet and can be compared. Solar flux, Proton flux, X_Ray flux levels will also be carefully monitored and compared with reported events. However due to the intense summer 'ES' this does seem difficult to collate.

News, views, photos and anything concerning VHF and above can be sent to: Geoff Brown, TV Shop, Belmont Rd, St. Helier, Jersey Channel Islands, or faxed to 01534 877067, better still sent via Email to equinox@itl.net

Don't forget to look up http://user.itl.net/~equinox for the latest information on Amateur Radio on the Internet and more news on Sporadic 'E' openings.

DATA CONNECTION

Our data SysOp G4HCL goes international with a careful look at message addressing

If you use the packet network, whether this be your local BBS, DX Cluster, or TCP/IP node, you'll be aware of how slow things can sometimes be in getting data from one part of the country to the other. Multi-hop transfer delays of up to an hour in what would otherwise be an instantly reported DX 'spot' on the Cluster network can often mean the station has gone QRT by the time you tune there.

Many of us are used to almost instant data communication via landline means. But even this, the Internet being a prime example, can become extremely frustrating at times due to congestion, so we're not alone. But we *can* do something about it on *our* network. Think of the investment you've got tied up in computing equipment and experience. If you're not already in touch with your local packet network group, why not find out who they are?

BBSs, DX Clusters, TCP/IP and so on are all well and good, but to function they need good trunk links for interconnection. "Support" doesn't just mean "money". Maybe you're on a good site which you could offer the use of as an interlink? If you've time to spare, how about helping your group out at the next rally they have a stand at, or if you've knowledge and experience, or maybe access to test equipment, offer to help the group in this way if you're able to.

Regular readers will know that I'm always very happy to publicise the work such groups do, I also try to help out when I can. For example, one of the sets in this month's ex-PMR conversion feature has been given to a local packet group, the other to a local school radio club to act as a 24hr packet node as well as giving the Novices there a 'real time' packet rig to use.

New Scottish DX Cluster

Following on from last month, the SDX Support Group say they are delighted to announce their GB7NDX DX Cluster project came to fruition ahead of schedule. GB7NDX was enabled on Sunday 17th December and is operational on 144.675MHz from the station of Bill GM4WZY in Brechin, Angus. The SDX Group gratefully recognise that this has been a project requiring cooperation and financial support from many quarters besides their own resources and technical department, and advise that there is still a great deal to be done with a user access network for Perth/Dundee and Aberdeen. The Group wish to thank Bill GM4WZY for giving GB7NDX a home, to the Aberdeen ARS for their generous donation of £200 towards the cost of the DX Cluster software for GB7NDX and the loan of equipment, Stewart GM4AFF for his generosity in supplying a computer, TNC card and rigs and also to the MacPAC Group for use of the Glasgow/Angus route that forwarding between GB7NDX and GB7SDX takes place on, plus the loan of a 70cm radio. Further details from the Support Group's Secretary, Ray GM4CXM@GB7SAN.#78.GBR.EU

GB7FW node

SUNPAC, the Southern Users Packet group, say they've obtained permission for a node to be sited near the village of Farleigh Wallop, between Basingstoke and Alton. The proposed callsign is GB7FW, and the details given here are also at the proposal stage and comment is invited on them. It is envisaged the links through GB7FW will provide inter-BBS, inter-Cluster and inter-Hub facilities, in addition to allowing improvements to user access from areas such as Andover. It's hoped that GB7FW will become the next node in the West_East 9k6 duplex backbone from Forest of Dean/Gloucester, through Swindon and GB7SW at Salisbury. There's also a potential for GB7FW to feature on a future North/South high speed (38.4 kilobaud?) backbone, which will necessitate the use of 1.3GHz and higher, equipment.

It's probable that GB7FW will initially have two duplex 70cm links, other proposals discussed include a 50MHz 9k6 simplex port, to provide distributed user access (i.e. to link in other, possibly informal, nodes to enable 1200baud access on 2m or 70cm from outlaying areas), and this may also be used initially to provide inter-Cluster linking. It's hoped that GB7VES (Frimley) will be linked directly to it.

There are some items that the group will need; several TNCs with 9k6 modems, coax, connectors, aerials and PSU's, to name but a few. The group say they also need *you* if you could reach the site in 30 minutes or less from home, to provide the local closedown list for the licence, and to provide first_line support to the installation once it is there. One amateur has been found, but at least another four or five people are needed. If you'd like more information or think you can help, contact the group's Secretary John G8OQN @ GB7XJZ.#48.GBR.EU

Addressing messages

An easily-solved problem I've heard of many times from packet BBS SysOps is that of wrongly addressed mail. Indeed, I was interested to read a message from EI7GM about a new 'G' callsign series for Northern Ireland, that of G1xxxx (letter G, number 1) rather than GIxxxx (letter G, letter I). Don't laugh, it can very easily happen, and it often does. I know of many messages to GO (letter G letter O) stations that 'bounce back' to the sender, when they've used the letter O rather than number 0 in their message address. The human eye often can't tell the difference easily, and most of us (myself included) still haven't reached further than two-finger typing.

From ZR

On the subject of addressing, Ray, ZR6RSW@ZS0DLD.TVL.ZAF.AF sent me a message to say 'Data Connection' was one of his favourite monthly 'reads', and offers a suggestion to help those readers who are outside the UK. Ray asks if I could provide *the full* packet addresses for UK BBSs, to enable him (and of course others around the world) to send messages to users at those BBSs. I always do this whenever I have the information, and hopefully you'll see this is the case for all contact details via packet given in this month's column. Unfortunately, many packet messages, including (especially?) those from overseas

arriving at my local BBS often don't have the full address of the originator in the message, although a 'read verbose' command will normally display the full routing information, allowing this to be obtained.

This of course isn't limited to just this column, and Ray asks if there's an easy way. I've already sent him a file by email with info, but with this in mind, an offered information file from G7OEB@GB7LEN.#16.GBR.EU could be useful to many stations, including Dave G7KTB@GB7BST.#32.GBR.EU who asks if anyone knows of Caribbean Nodes and mailboxes plus which stations can link up to them (contact him direct if you have info).

Israel Digital Award

If you're interested in a nice award from 4X land, here's your chance, even if you don't operate on HF. Shlomo, 4X6LM @ 4X6SL.ISR.MDLE gives information on the Israel Digital Award, which is open to all licensed amateurs. All bands with digital modes (RTTY, PACTOR, AMTOR, PACKET RADIO, SSTV) may be used, contacts must (naturally) be with stations in Israel, but QSOs with the same station on different bands are allowed. HF contacts count as two points, a packet message QSO counts as one point, and you need a minimum of 10 points for the award. 4X6LM says amateurs may send a packet CQ message to CQ@4Z4AAA.ISR.MDLE with the subject of "Israel digital award". QSLs aren't required (you can confirm via a packet message), but to apply for the award you should provide a list, showing full details of contacts with QTH locator, the list having been certified either by the Awards Manager or two local amateurs. Contacts on or after January 1, 1994 are valid. The fee for the award is 5$ or DM.10, and the address for applications is; Shlomo Mussali 4X6LM, Post Box 8225, Jaffa 61081, Israel.

Disabled help

Further to my mention of packet for blind amateurs, I received a letter from Des G8SBU who'd like to get onto packet, although being registered blind is interested in any 'talking packet programs' or any other talking utility programs, maybe those using a sound card, that may be around. I know of one or two Windows-based 'talking' applications, but have readers any more specific information? If so, please do get in contact with me, I'll be pleased to pass on any information for the benefit of Des and all others.

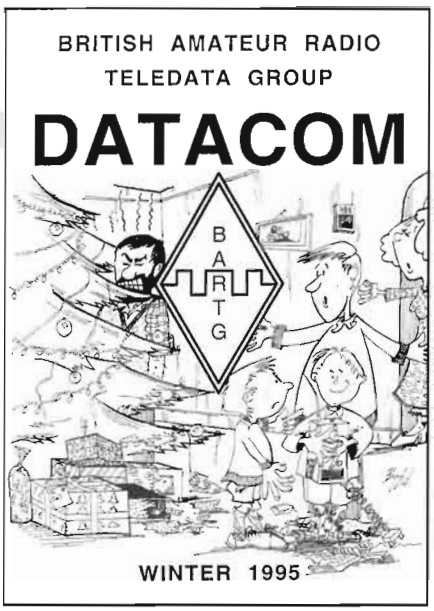
Nigel, G0RRW @ GB7DBY.#23.GBR.EU who's active on packet radio from his QTH in Burton-on-Trent, is paralysed from the neck down, and thus suffers a different problem, that being of data *input* to the computer keyboard rather than reading the *output*. He says he finds it very awkward to type his messages using a suck and blow switch and a device called a Headmaster, which basically controls the mouse on his computer, it can thus take him quite a while to do any typing. He'd like any information on voice recognition with computers, as he'd naturally find this very handy for data modes, if you can help get in contact with him direct.

Psion 3 packet

After having successfully used a Cambridge Z88 for packet on the move, last year I also successfully used a Psion 3 series personal organiser for mobile data, in this case for GPS-based packet work. I know a number of amateurs have a similar organiser, but they seem to have problems in using the serial RS232 interface with a TNC. The answer here is very simple. The RS-232 lead is usually always configured to link with a PC for file transfer, i.e. it's a 'null modem' cable configured for use with a DTE (Date Terminal Equipment) rather than a DCE (Data Communications Equipment). In other words, the data and control leads are suitably crossed over to allow communication being 'like' units. One easy solution is to simply place another 'null modem;' cable in line - you can usually get these from a computer dealer for a couple of pounds. If however you'd like to make up your own, here's the information, with my thanks to David G4ASR@GB7MAD.#24.GBR.EU for reminding me of this. You'll need two D type connectors and a few pieces of wire, connect the pins as shown in Table 1.

Table 1. Null modem cable connection

Organiser	*TNC*	*Function*
Pin 1	Pin 1	Frame ground
Pin 2	Pin 3	TXD / RXD
Pin 3	Pin 2	RXD / TXD
Pin 4	Pin 5	RTS / CTS
Pin 5	Pin 4	CTS / RTS
Pin 6 & 8	Pin 20	DSR & DCD / DTR
Pin 20	Pin 6 & 8	DTR / DSR & DCD
Pin 7	Pin 7	Signal ground



Spring RTTY contest

This month sees the BARTG's spring RTTY contest, which takes place from 0200 GMT on Saturday March 16th to 0200 GMT on Monday March 18th, on the 3.5, 7.0, 14, 21 and 28MHz amateur bands. There's full information in the BARTG's journal, Datacom, although briefly, messages consist of: RST/ Message No. and time in GMT. Besides entering the contest, this is a good change to work those few extra countries on RTTY.

If during the contest you manage to contact 25 or more different countries on two_way RTTY, a claim may be made for the *Quarter Century Award* (QCA) issued by BARTG, for which a charge of 6 US$ or 30 IRC's is made. Holders of existing QCA awards may add new countries to their existing records. Further information and any comments (which would be appreciated) on the contest and/or the award can be obtained from the BARTG's Chairman & Publicity Officer, Andy G3ZYP @ GB7MXM.#36.GBR.EU

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 communication side of things, or indeed what your local group are doing. Likewise 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 out. 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

Satellite Rendevous

Richard Limebear G3RWL with details of an 'interesting time' for Oscar 13 in this month's AMSAT-UK news compilation

The planned attitude schedule for Oscar 13 for the forthcoming months is:

Date	Alon/Alat	Weeks
Apr	1180/0	10
Jun	10220/0	t.b.a.

The session beginning June 10 will also last for about three months. After that, in September, the perigee height will be 170 km and re-entry effects will already be noticeable. This will be an interesting time, and the command team welcomes suggestions which they could implement to make use of this unique opportunity to observe an amateur spacecraft at re-entry.

The most sensitive indicator of drag on any satellite can be found in the value of *Mean Motion*. As drag takes effect, Mean Motion increases, and the satellite appears earlier than if there were no drag. This effect is cumulative, and any earliness rapidly becomes very apparent. The effect of this drag is now clearly noticeable in the AO-13 Kepler elements.

The predicted values of Mean Motion and other elements are based a model that includes a best estimate of the aerodynamic profile of the satellite. As time goes by, the agreement between predicted and actual Mean Motion will be used to improve this estimate, and so to improve re-entry predictions. Regularly updated AO-13 decay information is available at: ftp://ftp.amsat.org/amsat/satinfo/ao13/decaykep.zip (13k)

Full information about AO-13 is available via the Internet by anonymous FTP at ftp://ftp.amsat.org/amsat/satinfo/ao13/ . The files are:

schedule.doc Current AO-13 transponder schedule
ao13keps.doc Current smoothed Keplerian elements.
decaykep.zip 200 AO-13 future 2-line keps up to re-entry
mmplot.zip Mean Motion predicted and actual history. Pics.
spec_tlm.doc Full AO-13 telemetry specification & RF format
spec_wod.doc Format of whole orbit dump K and L blocks
spec_crc.doc P3 telemetry CRCC specification
events.doc Explanation of Event flags
demod.zip MK II Decoder spec, sources, MK I mods. Pics.
telemetry Sub-directory telemetry archives, 1988 on.

(Ed's note - I've arranged for the latest versions of all these files to also be available on disk for the benefit of readers from the HRT Software Service until the satellite's re-entry - just ask for the 'Oscar 13 disk).

Oscar 10

Its still operational in Mode-B. Despite good signals from the transponder, there are very few stations using it. Its currently available when in view but ***please do not*** attempt to use it if you hear the beacon or the transponder signals FMing.

MIR 2m, 70cm, and SSTV activity

Because of some missing parts, like the diplexer for the duoband aerial, the 70cm activity of *MIR* has been delayed. These parts and a TNC for 9600 baud are on their way to MIR on a *Progress* supply transporter. The frequencies to be used on 70 cm are 437.925 MHz for voice and 437.975 MHz for packet. The mode will be simplex. The present intention is to use the TM-733 on 70 cm and keep the old 2 metre radio working, so it will be possible to talk with them and work packet at the same time. Apparently there should be tests on 70 cm soon.

Most of the SAFEX II equipment has been taken to Kaliningrad by DL2MDE and DG2MJW and handed over to the Russian partners. It is installed in the new *Priroda* module which will be launched in March. SAFEX consists of two parts: a 70 cm part for direct and repeater voice QSOs, and packet radio, and a 13 cm module for broad bandwidth modes like e.g. ATV. Some missing parts of this module will be taken to MIR with supply missions later. A technical description of SAFEX II was published in the recent AMSAT Journal.

F1EBE in France has successfully received slow-scan television images from Mir. SSTV was copied on 144.550 MHz and 145.550 MHz FM in AVT94 (Amiga Video Transmission 94 seconds/frame) mode. The only problem is that AVT94 is not as popular as Martin and Scotty SSTV modes among ground stations. It is hoped that the cosmonauts will switch to the other SSTV modes in the future. (This is the first I had heard that they had SSTV on board!).

Microsats

KO-25 is still closed for uploads but it is possible to update directories using the 145.980 MHz uplink; no other information is available.

DOVE suffered a crash, came back, and then crashed again (29 Dec). They are investigating a possible hardware problem.

WEBERSAT (WO-18) is currently sending telemetry, photos, weekly Whole Orbit Data (WOD), and light spectra of the Sun or Earth, on Mondays. The *new* attic software for the experiments (camera, spectrometer, etc.) continues to be debugged and will be 'patched' in as it becomes available.

A recent change in WeberSat's on-board software allows the rate at which WOD packets are transmitted to be command adjustable. Therefore, on Mondays during the transmission of light spectra data the number of WOD packets sent per minute will be increased to a much high rate than normal. This should provide the user with all the week's WOD in one pass!

The satellite's digipeater is *now on* and can be accessed on 145.900 MHz! Using a terminal program connected to your TNC/PSK modem, try connecting to yourself using the following line substituting your own call in place of mine: cmd: C G3RWL VIA WEBER-1. Next try a few CQs and see who is listening...Enjoy!

Additional Phase 3D donation

At the RSGB's Annual General Meeting on the 2nd of December, the President, Clive Trotman, GW4YKL, presented a cheque for £25,000 to Ron Broadbent, G3AAJ, for the Phase 3D satellite project. In addition, it was announced that the Society's Council has agreed to make a further contribution of

£25,000 on condition that AMSAT-UK raises a similar amount from other sources. AMSAT-UK *has* raised this amount so an extra £25k *is* on the way. The resultant £75k is being applied to a doubling program in the USA to result in £150k towards Phase 3D.

Frequency coordination

Hans van de Groenendaal ZS5AKV, IARU Satellite Advisor, has appointed Graham Ratcliff VK5AGR as the IARU AMSAT Frequency Coordinator. Graham was selected from a number of nominations made by international AMSAT Groups for his long association with the Amateur Satellite program and his performance as a ground command station for AMSAT OSCAR 13.

Surrey satellites

Doug Loughmiller KO5I left his post as Spacecraft Operations and Groundstation manager at Surrey Satellite Technology on December 12th and returned to the United States. Doug said his time in England was an enriching and enjoyable experience; he deeply values the friends he made during his stay here and truly hopes that he will be able to stay in touch once back in Texas.

Still on the subject of Surrey, the first paper has been added to the premier edition of their journal. The paper is entitled 'Ionospheric sounding on a microsatellite' by David Palmer and may be of particular interest to the radio amateur community. From now on, papers will continue to be added to the this issue. Once sufficient papers have been put out, an editorial will be added, and the first issue will be pronounced published.

A reminder that the full size model of the FASAT-ALFA satellite is on display as part of the 'Future Innovations' program in the Space Gallery at the Science Museum in London. This will be of particular interest to radio amateurs as it shows the UoSAT bus system used on UoSAT-5 and KITSAT. The exhibition will be on show until May 1996. Further details of opening hours etc. are available from the Science Museum, Exhibition Road, London SW7.

Information files and satellite programs

An ANS reminder, contributions to the archive of satellite-related files and programs available for anonymous FTP on the host *ftp.amsat.org* are very welcome. The rules:

1. It must be related in some way to the amateur satellite program.
2. The file must be freely distributable.
3. Shareware programs must be useful as downloaded, not crippled adverts.

Contributions of material for the AMSAT Web pages are also welcome. W0SL has uploaded three .WAV files that contain recordings of radio signals received from OSCAR 1 (OSCAR1.ZIP), Explorer 1 (EXPLORE1.ZIP) and Sputnik 1 (SPUTNIK1.ZIP). The files each are around 100k each in size and will play about ten seconds of audio.

AMSAT-UK news

This year's Colloquium is booked for 25th to 28th July 1996. It has been decided that the first day (Thursday) will be dedicated to administrative (political) affairs with the other days being used for all other subjects. The price will be the same as 1995. There will be a barbecue on the Friday night.

G3UPZ has sent me details of an Internet web-site for up-to-the-minute Keplers which are updated regularly during the day: *http://www.nari.ee.ethz.ch/~tobias/kepler.html*. Thanks Howard.

Ron G3AAJ says that folks who have donated £150 to get their callsign on P3D should get their plaques soon. We still need more (there's two paid staff in Florida now). The Italians have donated a few thousand recently.

Did you know that amateur radio societies *can* become affiliated to AMSAT-UK? It entitles members to a percentage off goods etc., write for information.

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. SWL's are welcome. All new joiners get the USAT-P tracking program on 5¼in disk. G3RWL can now be reached via Internet as g3rwl@amsat.org.

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 41 from the satellite menu for this month's. You can also get a copy in the post by sending an SAE together with the corner flash from this page 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).

Upcoming Space Shuttle missions

Mission	launch	length in days	inclin.	config.	op.modes
STS-76	21/3/96	9	51.6	M	FM voice
STS-78/LMS	27/6/96	16	39	C	FM voice/packet
STS-80	11/7/96	16	28.5	C	FM voice/packet
STS-81	12/5/96	9	51.6	M	FM voice

Note: All configuration M flights will be dockings with MIR; these are the only ones visible from UK.

AO-13 Transponder Schedule to Apr 1st 1996

Mode-B:	MA 0 to MA 140	*Provisional*
Mode-BS:	MA 140 to MA 240	
Mode-B:	MA 240 to MA 256	Alon/Alat 220/0
Omnis:	MA 250 to MA 140	Move to attitude 180/0, Apr 01

Continuous up-to-date information about AO-13 operations is always available on the beacons, 145.812 MHz and 2400.646 MHz in CW, RTTY and 400 bps PSK. The Engineering Beacon (EB) 145.985 MHz is ON from MA 0 to MA 40. This beacon is about 6db stronger than the general beacon (which is *off*), so facilitating telemetry collection at perigee when the omni-directional aerials are in use. The EB is PSK only; it does not transmit CW or RTTY.