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please mention HRT when replying to advertisements.
ICOM BASE STATIONS


Tech Talk from ICOM: THE EXCITEMENT OF SATELLITE COMMUNICATIONS

An ever increasing number of radio amateurs are joining the excitement of Phase 111 - type satellite communications. This new medium combines the communications range of the 20 and 80 metre bands with the line-of-sight reliability of 2 metres. It's equivalent to a totally new band, and a vast technical background is not necessary for enjoying the action. ICOM is able to help you enjoy the fascinating new capabilities of OSCAR and future amateur satellites. Its all mode 2 metre and 70cm base transceivers bring the operating conveniences of low band units to the VHF and UHF amateur bands. They can be used for local FM operations via repeaters or for SSB/CW communications via Phase 111 satellites. The IC-1271E all mode 23cm transceiver is in a class of its own, providing mode L satellite uplink capability. (Mode L: 1269MHz uplink, 446 MHz downlink) (Mode U: 435 uplink 145 downlink). Satellite relayed signals are somewhat weak in nature and the IC-275E's low noise/high sensitivity receiver gives the highest performance for hearing everyone regardless of their uplink performance. The noise blanker prevents pulse type electrical interference from masking desired DX signals, the selectable AGC can follow fast fades associated with spin modulation. There are also the 99 mode memories which can be used for intermixed FM repeater and SSB/CW operators. When the IC-275E is equipped with the optional mast mounted AG25 GaAsFET pre-amp, it becomes a satellite operations dream come true. ICOM’s IC-475E 70cms transceiver has a front panel continuously adjustable power output to allow for daily signal variations. This overcomes the practice of over loading a satellites on-board receiver. The IC-475E also includes 99 all mode memories for the ultimate in operating flexibility. Using the ICOM CT16 satellite communications interface these base stations will track together via the ICOM CI-V system. If you are interested in joining today's most exciting era of amateur communications i.e., OSCAR and future Phase 111 satellites, ICOM is the logical choice for top performance equipment.
Count on us!

MORE BASE STATIONS

IC-1271E, 1.2GHz Multimode Transceiver

ICOM, a pioneer in 1.2GHz technology are proud to introduce the first full feature 1240-1300MHz base station transceiver. Features include: multimode operation, 32 memories, scanning and 10 watts RF output. The IC-1271E allows you to explore the world of 1.2GHz thanks to a newly developed PLL circuit that covers the entire band, a total of 60MHz, SSB, CW, and FM modes may be used anywhere in the band making the IC-1271E ideal for mobile, DX, repeater, satellite or moonbounce operation. The IC-1271E has outstanding receiver sensitivity, the RF amplifiers use a low noise figure and high-gain disc type GaAs FET's for microwave applications. The rugged power amplifier provides 10 Watts which can be adjusted from 1 to 10 Watts. A sophisticated scanning system includes memory scan, programme scan, mode-selective scan and auto-stop feature. Scanning of frequencies and memories is possible from either the transceiver or the HM12 scanning microphone. 32 programmable memories are provided to store the mode and frequency in 32 different channels. All functions including memory channel are shown clearly on a seven digit luminescent dual colour display. The IC-1271E has a dial-lock, noise blanker, RIT, AGC fast or slow and VOX functions. With a powerful 2 Watt audio output the IC-1271E is easily audible even in a noisy environment. The transceiver operates with either a 240V AC (optional) or 12 volt DC power supply.

IC-AG1200 Masthead pre-amp. Designed to use with the IC-1271E, the D.C. voltage and T/R switching for the amplifier is superimposed on the R.F. coaxial cable and switched by the pre-amp switch on the IC-1271E front panel. The new pre-amp provides excellent performance as a low noise microwave amplifier (0.6 noise figure typical).

IC-575, 28/50MHz Dual band multimode base station.

The ICOM IC-575 base station was developed to meet the demand for advanced communications for the recently acquired 6m band. Similar in appearance to the IC-275/475 2m and 70cm base stations, the beauty of this new transceiver from ICOM is that it gives you the best of both worlds, 6 & 10m in one compact unit. The IC-575 covers 28-30Mhz and 50-54MHz. Operating modes are SSB, CW, AM & FM. Power output is 10 watts (AM 4 watts) with a front panel control to reduce output for QRP operations. A pass band tuning circuit narrows the I.F. passband width, eliminating signal in the passband. A built-in notch filter eliminates beat signals with sharp attenuation characteristics. Some PLL systems have difficulty meeting the lockup time demands placed on them by new data communications. This is why ICOM developed the DDS (Direct Digital Synthesizer) method. With a lockup time of just 5msec the DDS method allows the IC-575 to handle data communications such as packet or AMTOR. 99 programmable memories can store frequency, mode, offset frequency and direction. A total of four scanning functions for easy access to a wide range of frequencies, memory scan, programmed scan, selected mode memory scan and lock out scan. The IC-575 has an internal A.C. power supply, but can also be used on 13.8v DC for mobile or portable operation. Optional accessories available are the UT36 voice synthesizer, the IC-FL83 CW narrow filter, SP7 external loudspeaker, HP2 communication headphones and S/M8/S/10 desk microphones. Other transceivers available in this range are: IC-275E 2m multimode 25w, IC-275H 2m multimode 100w, IC-475E 70cm multimode 25w, IC-475H 70cm multimode 75w.

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**HAM RADIO TODAY FEBRUARY 1988**

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*FT711RH £499.00 inc.*
INTRODUCING THE FT736R FROM YAESU

The FT-736R is a solid-state, frequency-synthesized VHF and UHF amateur transceiver incorporating up to four band modules covering the SO, 144, 430 and 1290 MHz amateur bands. The standard model provides 25 watts RF output power on the 144 and 430 MHz amateur bands in SB, CW and FM modes, with any two of the remaining three bands installable as options (10 watts output on the 50 and 1290 MHz bands). An 8-bit microprocessor and 4-bit/crystal provide exceptional digital integration and control including automatic tuning ranges and mode-dependent channelized tuning, selectable steps for each mode.

Operating conveniences usually found only on HF transceivers, such as front panel adjustable IF shift and notch, a noise blanker, all-mode VOX and three-speed selectable AGC are included. GAAS FET receiver RF amplifiers are provided in the 430 and 1290 MHz band modules.

The innovative memory system includes one hundred general purpose memories plus ten full duplex cross-band memories, all of which store receive and transmit frequencies and modes can be displayed and turned independently, or linked to tune synchronously in opposite directions for satellite operation. You can retain twelve satellite uplink/downlink modes in the special vice and ten full duplex memories at all times. Of course, metering of either transmitter or receiver parameters is selectable during full duplex communications. For CW operators, the FT-736R offers quick-changeover semi break-in and includes provisions for an optional internal electronic keyer and narrow (600 Hz) CW crystal filter when turned to 2-meter repeater subbands and a 1750 Hz Burst Tone Generator is installed as standard.

An enhanced CAT (Computer Aided Transceiver) System allows addition and customization of features and user-designed controls from an external computer. The FT-736R also includes a 40-channel synthesized 80-80 MHz. Metal restricted frequency hopping system and over 100 digital memories, one per band.

Each of the two duplex VFOs can be selected so that its receive and transmit frequencies and modes can be displayed and turned independently, or linked to tune synchronously in opposite directions for satellite operation. You can retain twelve satellite uplink/downlink modes in the special vice and ten full duplex memories at all times. Of course, metering of either transmitter or receiver parameters is selectable during full duplex communications. For CW operators, the FT-736R offers quick-changeover semi break-in and includes provisions for an optional internal electronic keyer and narrow (600 Hz) CW crystal filter when turned to 2-meter repeater subbands and a 1750 Hz Burst Tone Generator is installed as standard.

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Letter Of The Month
Raynet Revisited

Dear HRT, In response to the letter by GW1LN, (HRT, Dec '87), the answer to his question is really quite simple. Raynet do not own frequencies and they are obliged to operate within the amateur bands to the same rules as every other amateur. They may wish to nominate certain spot frequencies for operating convenience, but they have no specific right to them, neither is any other amateur under any obligation to avoid them.

They are not emergency channels and Raynet have no special priorities on the amateur bands which means that when they are playing games they must fit in with everyone else and have right to request any other station to vacate a particular frequency. They can of course ask politely. In the event of a real emergency I am sure most amateurs will move frequency to accommodate them.

M J Grierson G3TSO/KD3CL

More Homebrew please

Dear HRT, As there seems to be a general upturn in interest concerning homebrew, probably due to extortionate equipment prices and a desire return to basics, perhaps it is about time for you to begin another one of your excellent projects!

How about an SSB Transceiver for 6m or 4m? Or better still how about a Dual Bander? ORP of course, then we have a choice of PA's. For the HF operator there are already several excellent kits available so how about something for the VHF op? Keep up the good work.

M J Grierson G6VXM

The Facts of Life

Dear HRT, Ref: Class B's and HF. I feel I must put pen to paper to let a few folks know the facts of (radio) life.

If you want to drive a car, fly an aircraft, or operate an HF transmitter you need certain abilities, and a licence that says you have. There are valid reasons for this; to be allowed onto the HF bands with a transmitter and a GO call is to me, a privilege and an honour, and if the whining and bleating 'B' licence holders consider for a moment the damage their HF transmissions might do thousands of miles away to a professional CW station and not be able to read requests to cease QRM it might make some sense to them.

The HF spectrum is precious and there is no more — to be let loose on these areas CW is an absolute minimum requirement. I get very brassed off with repeated requests for novice (read 'lazy') bands, if this is what some people want then their prayers have been answered — there are three of them! (1) 26MHz (2) 27MHz and (3) 934MHz, and at a licence cost of (I think) £10. Any more questions?

Almost every letter I see from 'B' licensees tries (failing pathetically) to convince the world that they don't really want to use HF (honest), however I wouldn't mind betting that if HF was given to class 'B's' overnight we'd get trampled in the rush.

All in all, the pressure seems to be on for 'something for nothing.' I for one am a firm believer in 'what you put in, you get out.' It's quite simple really, if you want touse HF then CW is what you need. If as much energy went into learning it as seems to be expended on trying to get it for 'free' then I'm sure that more fun would be had by all around.

Lastly, I am reminded of an old Chinese proverb that goes a bit like: 'Better to light a candle than to complain forever of the darkness.'

E Greenhaigh GOAQI

Your letter raises a number of points. Firstly, as you rightly say, a licence is an indication of certain abilities but it is also true that 'hands-on' experience is also part and parcel of virtually any learning process. Secondly, how many class A licence holders really do make use of their Morse - and how many could cope with a morse QSO after years away from the modem?

The final, and most probably most important point, is that hams should be seriously concerned about the lack of new blood entering the hobby - if an introductory/novice licence or relaxation of morse requirements is what it takes then I would be in favour of it. I for one don't to be working a dwindling band of geriatrics when I'm 70 or so. — G4IRQ

Kapacitive Keyers

Dear HRT, As a newcomer to the bands I am a little confused about electronic keyers for CW — and at present I use the old original brass key. I am sure many other newcomers would like some articles upon this topic, dealing with the theory and practical approach, eg, how to connect the electronic key into our rigs, what ancillary equipment do we need? Perhaps an article on making such a keyer and equipment would help us.

I am interested in the idea of a touch type keyer — using the capacitance effect — one pad for dots and one for dashes. I cannot find any practical information on this topic.

Your magazine is of great interest and I always look forward to its arrival through the letterbox.

Francis Hook GOBOP

We'll certainly look into it. In the meantime take a look at our regular 'Morse Forum' and if any readers can help Francis out, do drop us a line.

A Newcomer's View

Dear HRT, Having been interested in ham radio for many years (early 30's) but unable to do much about it (mainly economic) I thought that now I am retired, I could seriously think about making a start.

I have HRT December copy and what do I find? Metrewave wondering why numbers of licences are falling. To me it is all too obvious by reading through your magazine. The undignified bickering between dog in the manger Class A's and Class B's. And what is the difference, a morse test which most Class A's forget as soon as they have passed.

Adverts! They seem to cater for the more-money-than-sense brigade and forget about the real homebrew enthusiast who has to think carefully before picking up a few quids' worth of third of fourth hand gear at a junk sale. How many folk like me can afford to lay out £1000+ on gear? We wonder if we could even afford to join RSGB.

It would seem from reading through your magazine that the amateur has to be a well heeled university graduate to even get started. There is a local club in Peterborough, but I back away from contacting them in case they look down their noses at
an old codger who is barely coming to terms with transistors. If I am wrong I apologise, but that is the impression I get from reading various publications.

E P Mapleston
There are cheap (sane?) ways to get on the bands, and quite a few perfectly acceptable secondhand valve rigs can be found in places such as our own Free Readers Ads section - I've never bought a brand new rig yet! Do give your local club a chance though, it's a good source of info, equipment and social contact and I'm sure that they would welcome a visit whether you are an old codger or a new one! - G4IRQ

A Gold Star for Spectrum
Dear HRT, I just had to put pen to paper. Whenever I read one of the radio mags there is always someone complaining about this, complaining about that. What about a complement for a change? Well this someone is Spectrum Communications Ltd.

Late one Friday night (10.30pm) I rang them to place an order, got an answering machine, fine, gave my name, address, charge card and what I wanted, and then waited about a week — nothing!

Anyway, gave a ring after 4pm, spoke to a very pleasant young woman who apologised for the delay due to the answerphone going wrong. Anyway gave her all the details, now this being Monday. She said it would be in the post first thing Tuesday and should be with me in a few days. Well first post Wednesday came my order. Boy!

All I can say, with your help is 'Thank you for a very fine service,' and let's have more fine services and thank you letters. Let's face it, amateur radio is meant to be fun, not only complaints.

Signed, a very satisfied customer.
Colin G1NPK

ATTENTION ALL WRITERS...

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We're looking for authors to help us keep 'Ham Radio Today' at the forefront of the radio scene. So if you've designed some novel or cost-effective gear, you've done something that is of interest to other amateurs, or you've got a controversial axe to grind, we'd like you to contact us!

If you're interested in writing for us, send us an outline of any ideas you might have and tell us a little about yourself. Write to: The Editor (submissions), Ham Radio Today, ASP Ltd, 1 Golden Square, London W1R 3AB.

Please note that we cannot be held responsible for the loss of unsolicited manuscripts. We advise all authors to keep a copy of any articles they send us.
We radio amateurs must spend thousands of hours on the air, yet little of our activities get into print. In this brand new bi-monthly series Steve Telenius-Lowe, G4JVG, looks back at the major HF events of the past few weeks.

As a regular reader of HRT I have long thought that the one thing the magazine lacked was a regular column about operating on the HF bands. A chance comment to this effect to the then Deputy Ed. at the RSGB HF Convention in September brought forth an immediate request for me to dust the cobwebs off the typewriter and to produce one. Initially, at least, the HF Band Report will appear every other month. I would be very interested to hear what you have been working on the HF Bands, which DXpeditions you think have been successful and which disastrous, which contests you have entered, which awards you are working towards, in fact anything concerning your HF operating activities. But I do not intend this report to degenerate just into a list of call signs worked, rather I hope it will be a chatty reflection of what has been happening on the HF bands over the last few weeks.

**The HF Convention**

The RSGB HF Convention held near Oxford has now surely established itself as the major amateur radio event of the year for those interested in HF DXing. There are no trade stands inside (though there was a small car boot sale in the hotel car park) — the organisers have made a deliberate decision that the HF Convention should not just be another occasion to look at black boxes, but rather a social event with lectures and slide shows of interest to HF operators. Their success in this regard is illustrated by the large number of overseas visitors who have travelled especially for the event. It was a great pleasure for me to meet some very famous call signs, some for the first time, and to renew acquaintances with others. The star of the show was Einar, LA1EE, who will always be remembered for his activity with Käre, LA2GV, on the first-ever DXpedition to Peter 1st Island as 3Y1EE. Einar showed some magnificent slides and gave a fascinating talk on their experiences down in Antarctica. John, ON4UN, was one of a large contingent of amateurs from Belgium which included Jan ON6JG of WAB fame and Ghis, ONSNT who has been on several expeditions to some rare countries. John was signing copies of his new book *Low-Band DXing* and apparently doing a roaring trade.

Suri VU2MY and Bharathi VU2RBI, who were closely involved with activating both the Laccadive Islands and the Andaman Islands for the first time for many years, were also there. They explained that no-one seemed prepared to give permission for operations from the Andamans, so they went right to the top: to Mr Rajiv Gandhi, himself a radio amateur. They are both now roving ambassadors for amateur radio and doing an excellent job.

**Andaman Islands**

Indeed, it was largely thanks to the efforts of Suri, Bharathi and others that there has been yet another recent expedition to the Andamans in October, using the callsign VU4GDG. I found them very easy indeed to work, even using an indoor 20 metre dipole: who would have thought this possible a few years ago, when the Andaman Islands was one of the rarest countries in the world?

The expedition had been on the
Hawk, SM5AQD, making the final adjustments to his 7MHz full size 3 element beam. The boom is 39ft long and the longest element is over 75ft!

air for a long time, and it seemed they were running short of people who wanted to work the Andamans for a new country. Nevertheless a few days later, during the CQ World Wide SSB contest, VU4GDG was attracting a huge pile-up, from contestants keen not only to get a rare country multiplier, but also one of the most difficult zones, zone 26. Despite the large pile-up, they were not too difficult to work on 15 metres, with operator VU2TS working the pile-up in grand style. I heard them later on 80 metres, but despite the fact that VU4GDG was a good signal (much stronger than previous operations from there) there was just too much competition to make it worthwhile calling.

The CQ World Wide Contest
During the CQ World Wide contest I operated from the Aston University club station, G3UOA, in Birmingham. The Aston University Contest Group is a new group of enthusiastic students and guest operators, who were entering the CQ World Wide contest for the first time. They have also taken part in the spring WPX contest, also organised by the American CQ magazine with some not inconceivable success, being the first placed multi-operator single transmitter entry from England last year.

Unfortunately, the antennas were not the best possible when the contest started, though we improved things during the contest. Arguably our most successful band was 160 metres, where a dipole supported at the top of two 21 metre high masts, which are themselves on top of the university buildings, 40 metres above street level, performed as well as high antennas are supposed to. Stations like VP9AD, UG7GWO, VE1ZZ and several USA stations were worked on 160 metres without too much difficulty, and as far as I know the only multiplier gotaway was WA8DIB/VP2M. Having operating from Montserrat on 160 metres in the CQ World Wide contest myself (as part of the VP2MW team in 1984) I can understand why, as the static QRN level was rarely below — and often much above — S9 on top band.

Other rare DX worked in the contest included KL7RA and HC8DX, both on 40 metres, who had huge signals for several hours after local sunrise. Since they both copied our 350 watts to a dipole, they must have had some splendid antenna systems. There was the usual spate of American expeditions to the Caribbean, and the amount of RF emanating from the Netherlands Antilles in particular was phenomenal, with PJ1B, P40V, P40R and P40SS amongst others all going great guns. Apart from the Americans, the Finns are probably the greatest contest expeditioners, and this year’s CQ World Wide was no exception, with Finnish DXpeditions to French Guyana (FY5YE) and Gibraltar (ZB2X) providing contestants with much-appreciated rare multipliers.

I often wonder why there seem to be so few British amateurs on DXpeditions, not just for contests, but at any time. Obviously it is very expensive to go to the Caribbean or French Guyana, but there are several rare spots around Europe, such as GD, GU, GJ, the Shetland Islands — which count as a separate multiplier and are also extremely rare in the CQ World Wide contest. Slightly further afield Malta, Liechtenstein, Andorra and even Majorca (EA6) would be a worthwhile destination for a contest DXpedition.

In at the Finnish
If I had to name just one person who was responsible for the tremendous activity and enthusiasm of Finnish DXers, it would have to be Martti Laine, OH2BH, who can always be guaranteed to pop up in an unusual place with a radio, and usually coinciding with the CQ World Wide contest. This year was no exception and Martti was one of the operators of SORASD, from the Saharan Arab Democratic Republic. At present, this entity does not count as a DXCC country, being that part of the Western Sahara which was formerly known as Spanish Sahara and is now part of Morocco. The Polisario Front, supported by Algeria, have claimed independence and have been recognised by the Organisation of African Unity, so it seems likely that the DXCC desk at ARRL will eventually recognise this operation too. In all such circumstances the motto is Work First, Worry Later!

When I heard SORASD it was on
OF0MA QSL card which is now being sent out for QSOs made in July and August. Left to right: GM3YOR Drew, OH0NA Kee, G4EDG Steve, G4JVG Steve and SM5AQD Hawk. In the background is the lighthouse, one of only three buildings on Market Reef.

10 metres, the Spanish operator was on 28400, and listening between 28410 and 28440. I cannot remember ever hearing a DXpedition station working as many callers so quickly. Not only that, he was changing from English to Spanish, Italian, German or French depending on who was calling, at tremendous speed and without getting at all tongue-tied! An excellent operation and the organisers are to be congratulated.

Conditions during the CQ World Wide contest were fairly good on the Saturday, with some good Stateside runs, especially on 15 metres, though very little from Japan and the Far East. On the Sunday, however, conditions were not as good, with an aurora affecting northerly signals and thus those from USA and Canada. While auroras may be merely annoying us for in Britain, they are decidedly bad news for those HF DXers in Scandinavia, where, in severe cases, all the bands can be reduced to loud rasping buzz-saw noises with very, very few signals at all coming through. SM5AQD, Hawk at Studsvik, near Stockholm, was operating on 40 metres single band during the contest and reports that on the Sunday conditions were very poor when, out of the blue, he was called by KH6XX in Hawaii when he (SM5AQD) was beaming south! Hawk has a full-size three element beam on 40 metres, with a very good front-to-back ratio, so such weird propagation effects can only be put down to the aurora. Hawk is one of Sweden's top contest operators and DXers and worked about 1100 QSOs, over 100 countries, and 32 of the 40 CQ zones in less than 48 hours and just on 40 metres!
It was a pleasure to meet Ghis, ON5NT, for the first time at the RSGB HF convention. Ghis has operated from some really rare countries, and used some weird callsigns, such as TYA11. Ghis is on the left with Jim Bullington, N4HX, on the right.

Market Reef
It was also Hawk who was one of the amateurs I accompanied to Market Reef last summer. Operating as OFOMA (the first time the OF0 prefix has been used on Market Reef), OHONA, GM3YOR, G4EDG, SM5AQD and myself made about 22,000 contacts with 145 countries. This is a new record number of QSOs for a single expedition from Market Reef, and the high total is because we were able to run two stations simultaneously, 24 hours a day. We were very lucky with propagation conditions, with good short-skip sporadic-E on 10 and 15 metres ensuring large numbers of European takers on both CW and SSB. We were also delighted to give what was obviously a new country for many Japanese amateurs, especially on 40 metres, where there was a good opening almost every single evening.

Full-colour QSLs have been printed, showing the operators (definitely not a pretty sight!) and our living accommodation, the lighthouse on the reef. Anyone who worked us, or SWLs who heard us, please send their QSLs to the expedition leader, Kee Eriksson, OHONA, SF-22430 SALTVIK, Åland, Finland, and please enclose an SAE and return postage, as Kee has many thousands of cards to send out. Please do not send QSLs for OFOMA to me, as I do not have the logs. However, I do have logs for my operations from Åland as OHO/G4JVG and would be pleased to hear from you. I would also like to receive your reports on what you have been working on the HF bands. Please send letters to me: Steve Telenius-Lowe, 'Penworth,' Tokers Green Lane, Tokers Green, Reading, RG4 9EB.
The only problem which may arise with the mixer synthesiser is that of the image frequency. As will be remembered from superhet theory, there are two frequencies which will mix with any local oscillator signal to produce the required IF output frequency, the unwanted one being known as the second channel or image. In the case we are considering, we find that, in addition to our 145.5MHz signal mixing with 115MHz to produce 30.5MHz, a signal at 84.5MHz will also work since 115-84.5 = 30.5.

Thus if our VCO is capable of tuning to 84.5MHz it is possible that it will go to this frequency when the channel is changed rather than the wanted one. In fact, the control voltage will operate in the wrong sense for the image signal, so the VCO will not stay on 84.5MHz but will charge off to the bottom end of its tuning range and stay there! This sort of behaviour will not be a problem in amateur gear, where the required tuning range is limited, but may be so in professional applications.

The Variable Modulus Prescaler
This is yet another solution to the problem of operating at high frequencies. Until very recently its use was confined to professional equipment, but it is now starting to be found in amateur rigs. This system does not use a programmable divider as such but a prescaler with two different divide ratios, the output of which drives two down counters.

The counters are loaded with two different numbers, the A counter holding a smaller number than the B, and both are then started counting down. When the A counter reaches zero, the division ratio of the prescaler is changed and the B counter continues to count until it too reaches zero. It then triggers a monostable to produce an output pulse, resets the counters and starts again.

The system as described so far thus produces a regular series of output pulses at a fraction of the VCO frequency, the division ratio being determined by the numbers loaded into the two counters at the start of the process, and it is this pulse train which is fed to the phase detector and compared with the reference to produce the error signal. A simplified block diagram is shown in Fig.3.

To illustrate the process, let us consider again the problem of generating a signal on 145.500MHz. As we said earlier, we need to divide this frequency by 5820 in order to get to our reference frequency of 25kHz. A common type of variable modulus prescaler has division ratios of 10 and 11, selected by feeding a 1 or a 0 to a control pin.

It turns out that we can get our required division ratio by dividing by eleven 520 times, and by ten 10 times, since 520x11+10x10=5820. In order to do this, we load the A counter with 5720 (=520x11), and the B counter with 5820. When we start the counters, the prescaler will perform the divide by 11 process 520 times, producing an output pulse each time; these pulses are fed to the A and B counters, each pulse causing the counters to reduce the count by one.

When the A counter has counted down to zero the 4 input NOR gate connected to its output will produce a 1, and this is fed back to the pin on the divider which controls the division ratio, thus altering the ratio to 10. The process continues until the B counter’s output reaches zero, at which point the 4 input NOR gate on its output produces a 1, triggering the monostable to produce an output pulse which is fed to the phase detector and also to the reset pins on the counters.

Synthesiser Versus VFO
At the start of this article, I said that the frequency synthesiser was not particularly well suited to SSB use, and we now know enough about the subject to see why this should be so. We have seen that the synthesiser produces an output which can be set to any given multiple of the reference frequency, and it thus tunes in discrete steps.

This is ideal for channelised operation, as practised on 2 metre FM, since it is simply necessary to dial up the channel number and you’re there, spot on frequency and with crystal stability.

On SSB, however, channelised operation is not the rule, for the simple reason that the number of channels would be too great to be practical; with channels 3kHz wide, there would be 316 of them in the SSB section of 2 metres, and whereas we can all probably work out in our heads where, say, S17 is,
Imagine being asked to QSY to channel 127! In any case, not everyone on SSB uses a synthesised rig. Thus VFO-type operation is the norm.

Furthermore, although a synthesiser will produce a signal with crystal-like stability, its frequency accuracy will depend on the frequency accuracy of the reference crystal, and the mixer crystals if a mixer type synthesiser is used. In amateur rigs there is generally a certain amount of tolerance in this and so, as anyone who has operated on SSB will have noticed, different rigs tend to have slightly different ideas as to their exact operating frequency!

Whereas on FM you can be up to a couple of kilohertz off channel without any adverse effect, on SSB it is necessary to be spot on. This is another reason why VFO operation is necessary for SSB, since you need to be able to compensate for the other station's (and you own) calibration error.

A synthesiser can be made to give an approximation to continuous tuning by using a very small step size. However, as shown above, reducing the step size worsens the phase noise performance, and unless the steps are made very small indeed (eg. 10Hz) we will only be able to get close enough to make his signal intelligible, but not to resolve him exactly. So we can see that the synthesiser is inferior to a VFO for this application in two ways. On the other hand, its frequency stability will be better than all but the best VFOs.

The main reason that synthesisers are almost universally used in modern amateur rigs, however, is their suitability for microprocessor control. Although it is possible to control an ordinary VFO with a microprocessor (as is done in the QUAD FM4 hi-fi tuner), it is much more difficult than is the case with a synthesiser. To set a VFO to a given frequency it would be necessary to know the value of tuning voltage corresponding to that frequency; thus the microprocessor would need to look up the voltage required in a look-up table, produce the number corresponding to that voltage, and then pass this number through a D-to-A converter to produce the actual control voltage.

Having done this, we would still not be certain that we were accurately on frequency, since the voltage values stored in the look-up table would only be valid for a particular temperature! By contrast, all we have to do with a synthesiser is to enter the appropriate channel number into the programmable divider and leave the synthesiser to do the rest.

**Epilogue**

By now I hope that the manner in which a synthesiser operates is clearer than when we started! The aim of this article has not been to equip you to design synthesisers, but to give you an understanding of how they work so that if your rig starts playing up, you might be able to do something about it. I hope it's been useful!
Still looking for something to recommend to the other half as a Christmas present? Fed up of fumbling around with your mobile rig under the dashboard? Maybe you fancy an in-car crossband repeater... with the Kenwood transceiver. This is unfortunately not possible when both transceivers are connected, neither is it possible to control both sets at the same time unless placing them in duplex mode, ie transmit on one and receive on the other.

The OK Yah brigade hit amateur radio with this rather neat remote handset for Kenwood mobiles. Chris Lorek gets out the green wellies and takes a closer look!

TM-221E 2m mobile reviewed in July 87 HRT, came the promise of a remote control handset that would do just that. As a crossband repeater cannot currently be used unless an emergency exists, we felt a quick look at what the RC-10 offers when controlling a TM-221E was in order.

Facilities
The RC-10 may be used to control either or both of the Kenwood TM-221E (2m) and TM421E (70cm) transceivers, and offers a backlit frequency display together with a numeric keypad for direct frequency entry or the control of ten memory channels — further buttons giving up/down frequency steps and scan mode initiation. Up/down volume buttons are fitted to control the main speaker volume, with a side-mounted three position switch controlling the earpiece volume. These volume buttons may be over-ridden by the main set rotary volume control if required by a handset mounted slide switch. A PTT bar controls transmit, and when the 'F' button is pressed in TX mode the set gives a 1750Hz toneburst for repeater access. A microphone socket is fitted to the top of the handset cradle, this may be used to connect a standard fist mic or a purpose designed mobile mic when using a single

Advantages
Many people would like to keep their mobile sets hidden away to deter theft rather than placing them on top of the dashboard where the display and controls may easily be seen. This often means a large amount of eye travel between the set and the road ahead, not exactly helping improve one’s safety on the road. A head-up display aids this greatly but the addition of head-up push button controls for frequency and volume change could be even more beneficial. By placing the RC-10 in such a position, one can immediately see the advantages.

As the unit appears not unlike a cellphone handset, the knowledgeable thief wouldn’t look twice, as the ESN (Electronic Serial Number) permanently programmed into every cellphone makes stealing one absolutely futile. The transceiver itself may be permanently bolted out of sight, connected to a dashboard switched DC supply to deter the thief who knows that it isn’t a cellular handset.

Repeater use
When linked to both transceivers, cross-band repeater operation is initiated by a double button press. Here, the sets are carrier operated, the squelch levels being set by two small presets fitted to the rear of the handset cradle.
When the squelch raises on one set, the other is placed into transmit mode, relaying the received audio and vice-versa. A transmit 'hang' time of three seconds occurs following squelch close, and a timeout of three minutes is employed.

This facility must of course be used with caution under our current licence conditions. Tempting as it may seem, it would be rather unwise to leave your car in a car park and go wandering off with a 70cm handheld, merrily chatting away on the local 2m channel. Having said that, if I were at the scene of a serious accident in mobile communication with a base station with a landline, I personally wouldn't have any hesitation in breaking my licence conditions if it would help injured people.

In Use

I coupled the controller to the TM-221E also supplied and busied myself programming the memories to my favourite channels. After driving off, I found individual memory recall very easy by simply pressing the button of the desired channel. Reverse repeater needed a double button press, and I eventually programmed the input frequencies of my two local 2m repeaters into adjacent memory channels for quick checking, using VFO mode for simplex nattering. As there was no Memory/VFO mode or offset indicators on the handset LCD, it took a little getting used to before I knew where I was; this was eventually solved by pressing a single key and finding out what resulted if I was unsure.

At night, I found the LCD illumination a bit on the dim side. Kenwood could really do with brighter bulbs in there I feel. Likewise there is no illumination of the push button controls, but after a short while I found operation by 'feel' fairly easy although this does limit the unit's effectiveness somewhat.

The reported audio quality on transmit was excellent although on receive the earpiece audio was on the 'tinny' side and rather limited in its frequency response. Most users, myself included, would normally use the main speaker for general reception.

Conclusions

The RC-10 could be very useful as a head-up display for one or two mobile sets, its use at night time is limited though due to poor lighting. The ability to select memory channels by a single touch is very useful, rather than cycling through several channels looking at a set's display each time until you find the desired operation frequency. Likewise, handset-controlled initiation of scan mode, toneburst and offset shift is extremely useful. It cannot however control two sets simultaneously in simplex mode, for example when scanning for activity one may select either 2m or 70cm frequencies but not both, a slide switch controlling the band change-over. Even so, for many users this could be just what they were looking for, maybe Father Christmas could be persuaded?

My thanks go to Lowe Electronics for the loan of the review equipment.
Want to use your 2m mobile as a multi-band HF rig? G3TWQ has the answer with this 160, 80, 20 and 10m transverter.

In August 1983, HRT published a design for a VHF to HF transverter by G4HDF which was modified the following December by G3WPO for operation on the LF bands. I do quite a lot of portable and mobile operating on the HF bands and the concept of a 2m multi-mode transceiver driving a VHF to HF transverter appeared to offer a lot of performance in a very small package. I was so impressed by the G4DHF design that I bought myself a FT290R and set about building a transverter.

However, as I began the project I realised that my requirements differed from those offered by the existing design in a number of respects — particularly for mobile use. To begin with I wanted four band capability for 160, 80, 20 and 10 metres with a little more output power and I also wanted to dispense with the preselector control and have an integral VSWR indicator fitted. With this in mind I embarked upon the design described here, which consists of three PCBs (Low Pass Filter, transverter and 'bought in' PA) installed in a compact metal box.

Block Diagram — Receive Path

The block diagram (see Fig. 1) shows the basic layout of the transverter. If we follow the receive signal path starting at the HF antenna input, we can see that the incoming HF signals pass through the VSWR detector to a bank of low pass filters. The appropriate filter is selected mechanically by means of a push button switch assembly fitted to the front panel which is also used to control the rest of the transverter. The output of the selected filter can then be switched so as to either pass through a 16dB resistive attenuator (to reduce receiver blocking effects) or passed directly on to the main transverter board.

On the transverter board (see Fig. 2) the incoming RF is fed to whichever band pass filter has been selected from the front panel. In this case the correct filter is not selected by direct mechanical switching but rather by means of diode switches which present high impedance paths in the 'off' state and a low impedance path when in the 'on' state. As a result, when the front panel push buttons are used to select a particular band, +12V is connected to the appropriate band pass filter diode network, bringing the filter into action.

Having passed through the band pass filter, the signals are fed to an SBL-1 double balanced mixer where they are heterodyned with the appropriate local oscillator frequency so as to produce an output in the 2m amateur band. As the transverter is designed to operate on four amateur bands, there are four separate local oscillator circuits, each being switched into circuit by means of diode switches operating in tandem with the band pass filters already mentioned. Finally, the output from the mixer is passed directly to the output socket of the transverter and on to the 'host' transceiver.

Transmit Path

In its transmit mode, the transverter essentially operates in the same way as on receive except that
the direction of the signal path is reversed. The central active component of the transverter, the SBL-1 mixer, determines the maximum input level of 2m RF from the transceiver by virtue of the fact that input levels in excess of -3dBm can lead to excessive levels of intermodulation products being produced. This necessitates limiting the input level to the transverter to no more than 0.5W which is typical of the low power settings for a number of 2m multi-mode rigs. In addition to reducing the power consumption of the transceiver, use of low power also reduces the levels of 'unwanted' 2m signals — it could be rather embarrassing to be called on 2m whilst working 80m!

The incoming 2m RF is further attenuated by a -30dB resistive Pi network which is switched into circuit when transmitting, before the low level signal reaches the double balanced mixer. Note that

Fig. 1 Block diagram of the transverter.

Detailed of the main transverter board, showing the four local oscillator sections and the RF screening.
only the first element of the pad dissipates much power (R1 and R2 in Fig. 2) so it is not necessary to 'beef up' all the components in this part of the circuit. Further protection against excessive input levels to the mixer is provided by two back to back diodes D1 and D2. Once the low level 2m RF signal reaches the mixer it is combined with the signal derived from the appropriate local oscillator so as to create a mixing product falling within the desired HF band. This is then passed to the relevant band pass filter. The switchable band pass filters used here are not as selective as the tunable version featured in the original design but are more convenient and in practice have proved to offer adequate unwanted signal rejection.

Transmitter Driver
The output from the filter section is not sufficient to fulfill the 1mW drive level requirement of the PA module — primarily because of the low RF levels used earlier in the mixer section — so amplification is necessary. This is carried out by Q2, a 2N3866 which gives switch selectable gain levels of 12dB and 6dB, the latter providing a 2.5W output from the transverter for tuning purposes. The gain of this stage is reduced when the forward bias on D4 is removed, introducing negative feedback around Q2 and reducing its gain.

Transverter switching
Initially, the transverter was built with an RF sensing system for Tx/Rx changeover, but following reports that the arrangement did not always operate satisfactorily it was decided to follow the example of others and simplify the design. The end result was the implementation of the direct switching system where the current limited DC output voltage found on the FT290 antenna socket was used to directly drive a TIP122 darlington package (Q1) which in turn switched the transverter relays. As the DC level is only present when the rig is in transmit mode, problems associated with dropping out during SSB speech pauses are completely avoided.

PA Module
Homebrew purists may feel that the use of a bought in PA module is something of a cop-out, however the design of a stable and reliable PA is not always quite so straightforward as one might first suspect. This, coupled with a reluctance to re-invent the wheel, persuaded me that the use of a Cirkit PA module was the most sensible solution. This particular unit is capable of providing in excess of 10W over a wide frequency range (1 to 30MHz).
from an input level of only 1mW and has survived numerous open and short-circuit outputs. Only one modification has been made to the standard version and that is the removal of the on-board link between the output transformer centre-tap and the 12V rail. Instead, the centre-tap connection is taken direct to the +12V supply and the other end of the link connection wired to the transverter +12V Tx line. In this way the Tx/Rx relays do not need to switch high currents.

**VSWR meter**

As can be seen from Fig. 3 the VSWR indicator is of a conventional design, employing a front panel mounted 100 microamp meter which gives a full scale deflection reading of about 10 watts. The circuit does not give a direct reading of SWR but measures the forward and reflected power levels.

Next month, local oscillator design and project construction details.

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**Components List**

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**Semiconductors**

| Q1 | TIP122 |
| Q2 | 2N3866 |
| Q3-6 | 6M279 (6 off) |
| D1, 2, 6, 7, 8, 17, 18 | 1N4007 (11 off) |
| D3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 19 | 100mA 400V Zener (4 off) |
| MX1 | Balanced mixer |

Note: D5 to D8 are part of Local Osc circuit.

**Miscellaneous**

| RLA, RL, RLD | Maplin Type YX96E or equivalent |
| XTALa, XTALb, XTALc | 70.5MHz |
| XTALd | 65.0MHz |

All crystals HC184, series resonant, fifth overtone type

1n feedthrough capacitors, 8 off

| SW1, 2, 3, 4 | 3-pole change over, interlocking, push-off, mutually cancelling independent push-on, push-off |
| SW5, 6 | On/off slide switch |
| SW7 | 100uA FSD meter |

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**Fig. 3 Low pass filter board circuit diagram with SWR meter connections.**
Telecom 87

Telecom 87, which took place at the end of October, was the fifth in a series of World Telecommunications of new developments from all areas of electronics, computing and telecommunication. In addition, seminars were held on a number of topics related to the electronics industry, but you had to be either very rich or very dedicated to attend these, as admission charges ranged from SFr 150 (£60) for a seminar on networks to a staggering SFr 800 (£325) for the 'executive symposium'. Admission to the exhibition itself was a comparatively modest SFr20 (£8), with a 50% reduction on Saturday and Sunday.

Although primarily a trader fair, Telecom 87 had much of interest to the radio amateur and electronics hobbyist. The amateur radio movement was represented in the form of a large display in the foyer, set up by the IARU and staffed by an international team of volunteers including the IARU presidents Dick Baldwin, W1RU. The stand included a full-scale model of the Fuji Oscar 12 satellite, a working packet radio station and a computerised satellite tracking system, as well as a number of photos and exhibits illustrating the various aspects of the hobby. A large selection of books and magazines was also available for visitors to browse through at their leisure.

The International Broadcasters' Pavilion, also in the foyer, included displays by the BBC World Service, Voice of America, Radio Netherlands and a number of other stations. Also represented was the EDXC (European DX Council), which is the umbrella organisation for short wave broadcast listeners' clubs throughout Europe. The Sony Corporation had managed to obtain some table space just outside the pavilion, and were showing off an impressive range of equipment including a portable radio which offered grouping together the various exhibitors from each of the 73 countries taking part. One stand not to be missed was that of the Soviet Union — which included not only a sizeable display of amateur radio equipment, but also a working HF station, callsign HB9/UK3F, which was made up entirely of equipment made in the USSR. Unfortunately, the operator must have been at lunch when we visited the stand, but friends told us that they had spoken to him earlier, and were able to confirm that the station had been on the air.

Other items of interest to the hobbyist were the various stands displaying satellite equipment and short wave listeners also had an opportunity to chat to Radio Beijing staff in the Chinese national pavilion.

For those who are able to plan ahead, the next Geneva Telecom will be held in 1991 — but make sure you get your hotel reservations in before the end of the 1980s!

Report by Angelika, GOCCI and Nigel, G4IJF.

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Now in orbit

Model of The Fuji Oscar 12 satellite.

Detail of one of the transceivers on the USSR stand.

View of the Soviet amateur radio stand.

HB9/UK3F 04

... but not heard

The main exhibition was mostly organised by way of national pavilions — some of them quite sizeable — and Nigel, G4IJF.

Seen...

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Report by Angelika, GOCCI and Nigel, G4IJF.
Men from MARS — first photo!

Well perhaps a little nearer home than the headline might suggest... Following their club elections the Midland Amateur Radio Society have notified us of their new club officials. Here we see Peter Haylor G6DRN being congratulated by the outgoing President Stewart Laing G8ODT. An ideal opportunity to remind readers that the club meets on the third Tuesday of every month at the club HQ, Henstead House, Henstead Street, Birmingham and to mention that new members are always welcome. For further details contact Norman Gutteridge G8BHE on 422 9787 or write to him QTHR.

From our Foreign Correspondent

News from the Netherlands this month includes details of their 'surprise' new 50MHz allocation which will be available to all except novice licence holders from the 1st of March. Described as an experiment, which will last right through until the 31st of December 1992, the new facility allows CW only operation at power levels of up to 30W in the 50.000 to 50.450MHz band. Although four years does seem to be something of a protracted experiment, the individual operator must apply for permission to use the band directly to the Dutch PTT. Having done so the licence variation is then in force for one year, after which time the applicant presumably has to reapply.

The USA has always had an unfortunate habit of allocating strange prefixes to the amateur population, many is the time that a ham has been caught out by a supposedly 'exotic' call only to discover that it is yet another US oddity. This time the occasion is the bicentennial of the US Constitution and so the special prefix will be... you've guessed it — 200! Fortunately not everybody will be using the call from stateside, only a selection of pre-registered club stations.

Still on that side of the ditch, but from a bit further north, comes news of a special reciprocal licencing agreement between Canada and the USSR. As from November 1st last year until the end of the event reciprocal licences will be valid and third party traffic permitted for the 'Canadian & USSR joint polar bridge ski trek', not exactly our idea of a stroll in the country but it is interesting to note that 'glasnost' is even having an effect in the world of amateur radio.

The Millennium Birthday July 10 1988

This is the final event planned for the year and it is hoped to demonstrate amateur radio in emergency and portable conditions. A special QSL card will be available via the IRTS bureau or direct upon receipt of 3 IRCs.

Dublin Calling...

The amateur radio operators of EI are planning great things for 1988, the reason being that 'Baile Atha Cliath' or Dublin as it is better known is celebrating 1000 years of its foundation as a city. To commemorate this Millennium a group of Dublin-based amateurs are organising three major events to run throughout the year the special event callsign E11000.

St. Patrick's Day March 17th 1988 For this, the most ambitious undertaking from an amateur radio viewpoint, an attempt will be made to make contact with the many towns and cities called Dublin around the globe (it is estimated that there are over 200) using not only SSB but also with the help of Precarranged skeds to attempt to make visual contact in a world-wide amateur SSTV link-up.

This station again with the special call-sign will be located in Dublins main thoroughfare of O'Connell St. adjacent to the St. Patricks Day Parade. It is hoped to relay live SSTV pictures from the front window of a prestigious department store to the public outside. The station will be active on HF for the day.

New add-on for A0R2002

The Aircastle 2002 Scanner Computer is a stand alone unit which is designed to go between an A0R2002 communications receiver and virtually any home computer with an RS232 interface and capable of running a 'dumb terminal' program. The unit offers much faster scanning rates of up to 150 channels per second, 400 memories (1000 with RAM expansion option), individually programmed attributes for each memory and the ability to back-up data stored in RAM. There is an offset facility which permits monitoring of duplex transmissions, an extended frequency coverage and frequency step range and well as a scanner control language which can be used to create new features as required by the operator. A to D techniques allow measurement of signal strengths in up to 255 steps and other facilities include an extended priority channel monitoring system, a squelch operated tape recorder control together with optional features such as a Centronics interface to directly drive printers and internal RAM expansion of up to 16K.

The unit retails at £169.99 inclusive of VAT and p&p and can be obtained from Aircastle Products, PO Box 78, Bournemouth BH1 4SP. Tel: (0202) 581089.

Ham Radio Today February 1988 please mention HRT when replying to advertisements.
Ever fancied a change from VHF/UHF mobile? Or do you have a favourite band and would like a stand-alone HF set, small enough to fit in your briefcase or rucksack as well as under your dashboard?

**Sick of Two and would like to work the world from your car? One of the latest Tokyo monobanders may be the answer – Chris Lorek takes a look.**

Tokyo Hi-Power, best known for their solid state linear amplifiers, have now brought out a range of HF monobanders that may fit the bill nicely. Luckily, the range was on display for the very first time at the Leicester show and we were able to come away with the very first 80m UK review model tucked under our arm.

**Features**

The Monobander series covers the HT-180 (80m), HT-140 (40m), HT-120 (20m), HT-115 (15m) and HT-110 (10m) sets, all offering identical features apart from their frequency coverage of 500kHz, starting at the LF end of each amateur band, with two switched 1MHz ranges fitted to the 10m model.

Each set operates in SSB and CW modes, with 20W transmitter output power and a ‘no frills’ single-conversion superheterodyne receiver. The receiver normally uses a single 9MHz crystal filter for both SSB and CW, however there is facility for fitting an optional 500Hz CW filter for the key-basher enthusiasts. Semi break-in CW keying is used, with an 800Hz sidetone generated. A receiver attenuator may be switched in to prevent strong-signal overload on

**Front Panel**

On the front panel an On/Off/Volume control is accompanied by a rotary RIT (Receiver Incremental Tuning) control, this also having a click-stop in its fully anticlockwise position to disable the RIT. A four pin mic socket is fitted, together with 3.5mm jack sockets for a CW key and an external speaker whilst above these sockets is a backlit analogue meter displaying receive signal strength and relative transmitter output power.

On the back panel are the aerial connector and DC power socket, and a 5-pin DIN socket with connections for 13.8V and 8V outputs on Tx and Rx, ALC input and ground. Four rubber feet are mounted on the bottom lid for base station use, and a hinged chrome metal bracket is fitted that allows the front of the set to be tilted upward if required.

The set measures 180(W) x 60(H) x 250mm(D), weighs 2.6kg, and comes supplied with a fist mic, a fused DC power lead with spare fuse, and an instruction manual. Optional extras stated in the manual include a mobile mounting bracket, an internal noise blanker to reduce ignition interference, an aerial tuner, mains power supply/extension speaker, and a matching 100W linear amplifier.

**Impressions**

The set is around the same size as the once popular Liner-2 mobile, and although larger than most current micro-miniature VHF/UHF FM sets it should still fit under the normal dashboard and leave enough room for your passenger's knees, which is more than can be said of many of the multiband HF mobiles on the market nowadays! The operating controls are very simple, lending themselves nicely to mobile operation.

However, the lack of some operating refinements such as memories, IF shift and so on, could limit its base station flexibility if you are normally used to these features. The set looks like a very nice piece of gear to take away on a boating or caravan holiday for instance, or even for a trip abroad to keep in touch with home from the hotel room — the set is very light to carry around.

**On The Air**

Reading the manual was not really necessary as the set was extremely simple to use, in fact the
literal Japanese-English translations could in some cases cause a little confusion, eg "In SSB mode, depends on low voice or high voice, and output will be change. But, even louder, output will not increase, and spurious will occur!" However, the manual certainly is useful in giving clear indications of internal adjustments, such as SSB mic gain, CW side tone level, carrier level and ALC adjustment, together with simple internal layout, block, and full circuit diagrams being included.

I first installed the set in my shack, coupled to the 80m trap dipole with its apex on the chimney of my two-storey house.

Switching on the set and power supply from 'cold' brings it up on 3.500MHz each time, a quick twist of the main tuning knob was hence required to set the frequency to my favourite part of the band. I found tuning normally occurred in 100Hz steps with 5kHz per knob rotation, however if the knob was rotated quickly using the finger hole, the rate increased to around 50kHz per rotation, allowing a fast QSY around the band. I found tuning relatively easy, but the 100Hz steps did not always allow me to get 'spot on' to the required frequency, and I sometimes resorted to placing the RIT in operation to obtain the correct beat note. Listening around at night on the SSB DX section at the top of the band was a bit of a strain on the ears due to the usual ORM noises, I felt the SSB selectivity was a touch on the wide side for this but then the set wasn’t designed for DX chasing was it?

**Strong Signal Performance**

Switching the attenuator in and out made no difference to readability, showing the receiver front end certainly wasn’t being overloaded. This surprised me as I would have thought the set wouldn’t stand up to this strong-signal treatment very well, earlier mobile-type sets as well as some general coverage receivers I have tested have not coped without 10 or 20dB of attenuation placed in circuit. I found the S-meter was rather on the mean side — a quick tweak with a trimming tool would have been performed if I owned the set.

On transmit, good audio reports were received when using the first mic supplied, even the slight echo from my relatively empty shack was commented on. I found that it was sometimes a struggle getting through on the 20W power output when calling some of the special event stations that achieved mini-pileups from award hunters. Do I really want a worked-all-haggis-farms certificate? QRP enthusiasts who enjoy a challenge may however appreciate the fact that it is possible to reduce the power down further if required, but as a beginner’s set I believe the low power could be a limiting factor if coupled with quickly strung up, inefficient aerial systems. However it must be remembered that 20W is only around a couple of S-points down on the usual 100W+ power used, and I certainly didn’t lose any QSOs through low power when operating from home.

**Going Mobile**

To test the set in mobile use, I replaced my usual 2m/70cm dual bander aerial with the 80m G-whip. Many VHF operators believe all HF mobile whips are monster affairs, but G-whip is only around the same length as a 2m 5/8ths. The set was placed under the dashboard, with the essential in-line SWR meter placed on top of the dash. The reason for this is that the bandwidth of HF mobile whips is necessarily narrow (typically 30kHz between the 3:1 points on 80m in my case, and a large QSY means nipping out and quickly sliding the top whip section up or down to resonate the aerial. Together with other HF mobiles, I find a length of card, marked with resonant frequency corresponding to the top-section length a very handy tool (my thanks to Dave, GOGWO for this tip). As the...
rig 'forgets' frequency whenever power is disconnected, I found it necessary to wire the DC lead to a permanent supply to prevent a retune each time I switched the ignition off.

**Power Limits**

In driving around, I found the large display was very visible, especially at night, and the controls easy to locate by touch alone. Due to the free-running nature of the tuning knob, I did sometimes find I accidentally knocked myself off frequency but soon learned to place the 'lock' button in as a matter of course after tuning. It would have been handy to have had Up/Down buttons on the microphone as the set is already tuned by up/down steps from the main knob, but each operator would have their own preferences I'm sure. Due to the relatively inefficient mobile whip (a full-size quarter wavecover 80m being around 15 times the length) signal reports on both transmit and receive were down on that achieved from home. It was occasionally frustrating to hear an S9 signal at night and to call in vain, but this would be less of a problem if, say a 20m version of the set were used. Even so, I would recommend the serious operator (apart from die-hard QRPers) to think about fitting a 100W linear, ex-CB broadband jobs for example can be bought secondhand for under £50.

I found reception of many daytime signals hampered by ignition interference, from my own vehicle mainly but also from the odd passing motorist. Various suppression techniques, including bonding everything in and out of sight (engine, bonnet, exhaust system etc) may of course be used to to reduce this, but I did feel the optional noise blanker would have helped a great deal, this unfortunately was not available at the time of review. It was very nice, though, on my fairly lengthy drive into work in the mornings, to listen to the various early nets and have the odd QSO with stations who I could normally only work from home — it could easily become a habit with yours truly.

**Delving inside**

The set is constructed on a metal chassis using three main boards, all with discrete components fitted. One board houses the majority of the analogue circuitry, on the other side of the chassis is the digital synthesiser board, and on the rear is the main transmitter power amplifier with its transistors mounted directly onto the rear heatsink through a cutout in the chassis. On the front panel, four small sub-boards contain the display LEDs and their associated drivers and resistor arrays.

The accompanying block diagram shows the circuit arrangement, the receiver front end uses a 3SK73 dual gate MOSFET feeding a single gate 2SK192 FET mixer, the noise blanker option being inserted before the crystal filter to overcome the pulse-stretching effect that
would otherwise occur. On transmit, the double sideband signal is generated using an SN76515 modulator/demodulator, the LSB or USB signal as appropriate being selected by the crystal filter common to the receive path, mixed to final frequency and amplified to the 20W level, the PA using a pair of 2SC2098s in push-pull. The local oscillator uses a 2SK241 FET VCO controlled by a parallel-driven MC145163 divider/phase comparator, a passive loop filter being used to filter out the reference frequency.

**Laboratory Tests**

The excellent blocking results confirms that noted on-air, this shows the synthesiser to be contributing little in the way of wideband noise to cause reciprocal mixing, this being possible where only a narrow band needs to be covered in use. The 3rd order intermodulation, where adjacent strong signals combine in the receiver to produce unwanted on-frequency interference was reasonable but not spectacular. The passband selectivity was better than I would have thought, this again was not widened due to synthesiser noise effects. On transmit, the higher order harmonics were well suppressed, and the two-tone tests showed the PA to be nicely linear. Once maximum PEP output had occurred overdriving the mic input in audio level to simulate shouting into the mic gave no visible degradation to the signal, showing the ALC to be effective.

When tuning across a steady carrier on receive, I noticed a slight 'twang' accompanying the normal 100Hz stepped melodic tones, suggesting a slight overshoot on the synthesiser. This led me to shake the set hard, sure enough a frequency wobble was evident showing the synthesiser to be a little slow. In use, this would show up under high vibration conditions as a wobble on both received and transmitted audio. Although no problems whatsoever were experienced when mobile in my car, drivers of rattly Land Rovers and the like may when stuck in a traffic jam rather than listening to the local 2m mobilers also complaining about the traffic!

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

**Conclusions**

A lovely little set, bound to appeal to HF addicts who would like to extend their activities outside their main station. As a beginner’s set it may be useful as a 'stepping stone' to a multi-band multi-feature job, but in this case I would recommend using a linear amplifier in the first instance, as most HF bands are something of a rattrace and it's a fact of life that the low-power station normally suffers as a result.

The technical performance of the set is perfectly adequate for normal ragchewing purposes, but ensure that if you use the set mobile you don’t vibrate it too much. It certainly makes a change being able to drive around, talking to the world when stuck in a traffic jam rather than listening to the local 2m mobilers also complaining about the traffic!

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  - High quality mag mount with cable and strong protective cover to prevent paintwork damage £22.90 inc vat, carriage £2.00
45 watts on 2 metres, the TM221E.
35 watts on 70 centimetres, the TM421E.

The new KENWOOD and TM421E two metre and seventy centimetre FM mobile transceivers have been specifically designed to condense maximum performance and operating convenience into a compact package. Output power is 45 watts on two metres (TM221E) and 35 watts on 70 centimetres (TM421E). Receiver sensitivity matches the output power of the set and measures an amazing 0.141μV for 12dB SINAD (across 144-146). The figures are those given by Chris Lofek in his recent TM221E review published in the July edition of HAM RADIO TODAY.

Much discussion has taken place recently regarding 12.5 and 22 kHz spaced frequency channels on the two metre band. With the new mobile channel spacing not being a problem. KENWOOD and their usual attention to detail have made the frequency step user selectable. The steps available are 6, 10, 12.5, 15, 20 and 25 kHz. Once programmed either microphone button (down button or the transceivers front panel knob can be used to step the transceiver across the band. Of course should it be necessary the selected step can easily be changed. A new orange backlit liquid crystal display gives the transceiver an amazingly clear frequency readout that can be read in the brightest of sunlight.

The transceiver has all essential operating aids. There are 14 memory channels, each of which holds frequency, whether simplex or repeater operation is required and whether or not the tone burst is on or off. Scanning can either be memory with the ability to look out unwanted channels or band with the scan limits set by the operator. The usual priority channel facility is also included to make sure that no call is missed. As well as showing the operating frequency the display also indicates which of the facilities are being used.

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

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

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

Although I have not seen the RC10, I am of the opinion that it will do much more than I have already described. I suspect that it will be possible for the RC10, when used in conjunction with both 2 metre and 70 centimetre transceivers to operate as a personal repeater. Parked at the top of a multi-storey car park and left unattended, I would not be surprised if you could talk into the installation from another small handheld on 70 centimetres (say a TM421E) and have your transmission rebroadcast at a higher power from the good location on 2 metres. Any reply would be retransmitted to you on 70 centimetres. Useful and ideal for staying in contact when wandering around town. Helpful also for RAYNET use.

Of course I may be wrong!

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

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

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

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

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

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

The transceiver has two separate VFO’s and forty memory channels. Each memory stores frequency, operating mode, whether simplex or repeater shift and frequency or memory scanning are possible with the TS711E (TS811E). DCS (digital code squelch) is also fitted to the TS811E (TS811E).

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

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

Frequency scan on VFO can either be between or outside user set limits. On memory the transceiver can either scan the entire memory content or be instructed to look at those frequencies of a particular mode. The TS711E (TS811E) has a timed hold on an occupied channel. When the user presses the button a specified length of time (default 1 second) the channel will be held and not allowed to change until the button is pressed again. The time delay can be re-set once the channel is occupied.

The T87113 (T8811E) has IF shift, an essential feature when the band is crowded during a contest. To help work DX, speech processing is also available.

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The T87113 (T8811E) has IF shift, an essential feature when the band is crowded during a contest. To help work DX, speech processing is also available.
Have you ever thought about getting a dual band mobile rig but almost passed out when you saw the price tag? You may be in for a pleasant surprise with the Alinco, because at £449 it's certainly the cheapest one changes to cover certain two-way radio allocations! The facia employs an array of push buttons and the number of functions are effectively doubled through the use of a 'F' button to provide a second function on.

The latest Alinco offering is the new 2m/70cms dual-band mobile. Chris Lorek dusts off the Rolls and gives it a spin!

I've seen — could it be worth a second look? Well HRT thought so, and here we go with the first UK review on a set that could be finding its way into one or two car dashboards very shortly...

Features
Readers of the Alinco ALR-22E review in HRT Dec 87 will notice a certain feeling of deja-vue, because the operating features as well as the front panel layout are virtually identical. The set measures a small 140mm(W) x 47mm(H) x 175mm(D), and offers coverage of both 2m and 70cm with 25W output on high power and approximately 5W on low. Two digital VFOs are provided, each with independently selectable 12.5kHz or 25kHz steps which offer continuous coverage of 144-146MHz and 430-440MHz.

I'm told by the suppliers that for the nosey amongst us the receive ranges are expandable by diode link for each. At the back of the set terminated flying leads are provided for the aerial, DC power, and microphone connections and a chassis mounted 3.5mm jack socket allows connection of an external speaker, this disabling the small internal unit fitted to the bottom lid.

Frequency control is performed either by using the main click-step tuning knob or by Up/Down buttons fitted to the fist microphone, 1MHz steps being controlled by set-mounted Up/Down buttons to get from one part of the band to the other quickly — or in fact from one band to another. For repeater working, as well as a push-button 1750Hz tone two programmable splits are provided, one stored in each VFO. The offset direction is selected by a push button which causes the set to cycle between +, - , and simplex settings. Reverse repeater checking is available by a two-button push to allow a quick 'listen on input' before attempting a simplex circuit.

Cross-VFO operation is provided by a 'Dual' facility and this may be used for non-standard splits or, when different bands are programmed in each VFO, cross-band full duplex (ie simultaneous transmit and receive operation) is achieved — providing of course that you're not trying to receive a 70cm frequency that is three times your 2m transmit frequency! The set also features a built-in duplexer to allow a single-coax connection to one of the many twin-band aerials on the market. By using an external duplexer, one can of course use separate aerials if you wish.

The set comes supplied with a quick release mobile mounting bracket and mounting hardware, a fist mic, a fused DC lead with two spare fuses, an external speaker and an operating instruction booklet, this having a block diagram and a small loose sheet showing part of the circuit diagram.

Thanks For The Memory
A total of 21 memory channels are available, each storing frequency and any programmed offset. Selection of memory channels is achieved by a press of the 'MR' button, the facia mounted Up/Down buttons then stepping through the channels. Once a memory channel has been selected, it is possible to QSY from this by a twist of the main tuning knob or by operating the Up/Down buttons on the microphone, which retains any programmed offset held in the memory channel. Further presses of the set-mounted Up/Down buttons then take you to the next memory channel.

Each button press is accompanied by the usual 'bleep' so loved by microprocessor controlled rig designers, but you can save your ears by disabling this with a small top-lid mounted slide switch. A keypad 'Lock' feature, selectable by
a facia-mounted double button push may also be used to disable all the function keys apart from the PTT, preventing accidental frequency shifts while you're driving along at night fumbling for the squelch control.

The operating memory frequency along with the current memory channel are shown on a large green-backlit liquid crystal display and a graduated bar-graph display along the bottom section of this gives an indication of relative receive signal strength and transmitter power output. Adjacent LEDs light to give indications of the receiver squelch state, transmit mode, and when 'Function' mode has been enabled.

Searching for Someone...

Memory channels may be searched for activity by a press of the 'Scan' button, the scan halting on an occupied channel and resuming either four seconds after the signal disappears or immediately on squelch close, depending on the setting of a small slider switch on the top lid. An adjacent switch is used to alter the scan speed to either four channels or twenty channels per second and any number of memory channels may be inhibited from scanning whilst still allowing manual selection. Quick access to memory channels 1 and 2 is provided by a 'Call' button, a press of this transfers you instantly to channel 1 whilst pressing the 'F' button first gives you channel 2. In VFO mode, a programmed scan is available, the set searching for busy signals in the user-defined channel steps between the frequencies programmed in memory channels 20 and 21. If that's not enough, a 'Priority Watch' facility is available which samples a pre-defined memory channel for one second out of every six when operating in VFO mode.

Inner Thoughts
The set looks exactly like a slightly fatter version of the ALR-22E, and I can only echo my previous impressions of a small, smart set with a high-tech appearance. Its size, together with the use of flying leads, would allow the set to fit into most nooks and crannies found in today's gadget-filled dashboards. The built-in duplexer would save the purchaser forking out another fifteen or twenty pounds for an external add-on unit, allowing a single unobtrusive aerial to be used on the family jalopy, or a quickly positioned magmount where the need arises. This, together with the quick-release mounting bracket, would provide for a quick getaway when the day's driving is complete and the set becomes a fixed station.

Again the operating booklet provided has no mention whatsoever of simple user adjustments, and does not mention any fault-finding information such as where to find and how to replace the memory back-up battery when it goes flat. I'm not a watch expert but even simple instruction leaflets for £1.99 watches show how to replace the battery, why can't transceiver manufacturers do likewise?

Inner Workings
The set is built on a diecast
chassis with the main RF boards for each band separated by a central moulding. This arrangement ensures mechanical rigidity as well as providing good screening and earthing, very important factors in a duplex rig such as this. The digital control circuitry is fitted on two smaller PCBs mounted on the front panel, to which the front panel controls and the small top-lid slide switches directly connect.

The accompanying block diagram shows that completely separate synthesizers are used under control from the MB88543 CPU, this allows each network to be tailored for the best performance possible as well as giving a full duplex facility. Each VCO is directly modulated by separate audio tailoring circuits, and the RF signal amplified to the 25W level before being PIN diode switched and fed to an on-board duplexer. This takes the form of low and high-pass filters so giving a wide bandwidth coupled with a reasonable degree of isolation. The receive signals are similarly split, being passed into a pair of separate front end amplifier and mixer stages to achieve a common 21.6MHz intermediate frequency. A pair of monolithic dual crystal IF filters provide the initial selectivity before the signal is downconverted again to 455kHz by the ubiquitous TK10420 subsystem IC, cleaned up further using a ceramic filter, and finally demodulated down to audio.

**In Use**

Initial tests were done on the road, the set being positioned on top of the dashboard as well as under the parcel shelf on the driver’s side. The first thing I noticed was the rather 'toppy' receive audio from the tiny speaker, plugging in my usual external communications speaker gave little improvement but eventually my ears became accustomed to it. I programmed the 21 memory channels with my favourite repeater and simplex channels and set about on my usual long journeys into work as well as the odd cross-country jaunt. I found the frequency display very readable when viewed from above, both at night and in bright sunshine, however when viewed from below whilst using the set vertically mounted between the front seats the display instantly becomes unreadable, so watch out. After I had got used to the positions of the small, function buttons, I had no difficulty in operating the set by touch alone, only glancing at the display quickly now and then to check which frequency I was on. The microphone Up/Down buttons only control frequency and not the memory channel, but the set does have an advantage in that these can be used to QSY from any selected memory channel, I often found this very useful when searching for signals. What a pity there was no toneburst button fitted to the microphone, as I would certainly have found this more useful than the facia-mounted button when accessing the 'tone quickly followed by speech' boxes which don’t accept a break in carrier. Transmitted audio reports were normally favourable if sometimes a little on the 'toppy' side but "Crisp and Clear" was the norm rather than "Sounds like you’ve got a sock up your nose" report which I’ve had with other sets.
There was ample receive volume using both the internal and my larger external speaker, but I did notice a 'pop' each time the squelch opened or closed on low volume settings. When using the external speaker with its higher efficiency this was rather offputting, to the extent that I often just wanted to switch the set off. The suppliers of the review set informed me that they hadn't encountered this problem before, so maybe I just had a 'rogue' one or I'm possibly being very fussy!

During the review period I used a 90cm Welz EL-770 dual band as well as a 20cm Comet miniature dual band aerial. I found the set operated perfectly into both of these, with similar signal reports to my 25w 2m and 70cm mobile rigs being given, showing both the internal duplexer and the general RF performance to be quite good. The S-meter though I found virtually useless, it was normally reading either full scale, zero, or varying wildly between the two extremes due to slight mobile flutter, not a lot of good.

I did find a better-than-average rejection of the Primary Band User signals, spaced 12.5kHz away from a couple of my semi-local repeaters around Northamptonshire, this allowed me to hear the amateur repeaters in locations where I had been having difficulty due to adjacent channel blocking. When using the set from home into a chimney mounted fibreglass dual-band colinear, I managed one or two pleasant duplex contacts using the Alinco, providing I avoided 70cm receive frequencies near to multiples of my 2m transmit frequency. Again in normal use I encountered no adjacent channel problems, either on 2m or 70cm, which is very good.

**Laboratory Results**

The receiver sensitivity was fairly reasonable on both bands with the very good 12.5kHz adjacent channel rejection measured also confirming the results obtained in practice. I was a little disappointed with the poor 2m image rejection, however, this falling right in the middle of Broadcast Band II but in the frequency range presently used by non-broadcasters. A simple coax notch filter could improve this however if the odd problem does occur in future use. The S-meter range was, as found on-air, very limited indeed in common with many FM-only sets.

On transmit, the set was very clean in terms of harmonics and spurious and I drew the line at trying to measure better than 100dB down! As a final test, I transmitted 145.0MHz on high power into a 50dB attenuator whilst coupling the other end to my synthesised signal generator set to 435MHz, ie three times 145MHz. I found that I needed to increase the signal level by 59dB from the 12dB SINAD level to over-ride the transmitted signal, showing that I could (if I really wanted) have a duplex contact with a nearby station on these two frequencies as well as any other 2m/70cm combination!

**Conclusions**

The set offers a good all-round performance at an economical price — I was in fact pleasantly surprised, and a such I'm sure it will be quite popular. It is very small, in keeping with many of today's midget rigs, but still relatively easy to operate by touch alone and you'd be hard pressed to find a car dashboard where it would not fit. However it may be a little too tall to place above the facia to ensure minimum eye-
travel distance whilst driving — this aspect being far more important than the use of 'safety mics' or whatever. It comes from a lesser-known manufacturer than the usual 'big three' and because of this, plus the meagre user servicing information provided with the set, I would advise the purchaser to ensure a good service backup is available from his chosen supplier.

My thanks go to Waters and Stanton Electronics for the loan of the review transceiver. The suppliers also inform us that they now provide an info sheet showing deviation adjustment points etc.

### Laboratory Results — ALD-24E

#### Receiver

<table>
<thead>
<tr>
<th>Parameter</th>
<th>145MHz</th>
<th>435MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td></td>
<td></td>
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<tr>
<td>Signal level required for 12dB SINAD</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Freq</strong></td>
<td><strong>Level</strong></td>
<td><strong>Freq</strong></td>
</tr>
<tr>
<td>144MHz</td>
<td>0.148uV pd</td>
<td>145MHz</td>
</tr>
<tr>
<td>430</td>
<td>0.164</td>
<td>435</td>
</tr>
</tbody>
</table>

| Squelch Threshold Sensitivity |        |        |
| **Freq** | **Level** | **Freq** | **Level** |
| 145MHz | 0.087uV pd | 44dB | 435MHz | 0.089uV pd | 25dB |

<table>
<thead>
<tr>
<th>Harmonics/Spurii</th>
<th>145MHz</th>
<th>435MHz</th>
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<tbody>
<tr>
<td>Harmonic</td>
<td>Spacing</td>
<td><strong>Freq</strong></td>
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<tr>
<td>2nd Harmonic</td>
<td>145MHz</td>
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<td>3rd Harmonic</td>
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<td>6th Harmonic</td>
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<td>7th Harmonic</td>
<td>145MHz</td>
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</tbody>
</table>

2m spuri at ±12MHz -82dBc
All other harmonics and spurii less than 100dBc

**General view of the rig complete with fist mic**
Every well equipped metrewave station today will include a sizeable and important 70cm element if it is to make maximum use of the available allocations. All you need to do is to sign a cheque for a 433MHz transceiver and antenna, and you have immediate access to the band. T' was not always thus. Back in the Fifties things were very much more difficult!

Jack Hum, G5UM, looks back over one-third of a century to the early days of the "ultra highs"

Just how difficult it was to get on to 70cm the hard way (there wasn’t a soft way) may be gauged from the fact that at that time a school of thought remained that only by using super-regenerative receivers and self-excited transmitters (SEOs) was it possible to effect a reasonably cheap and cheerful entry to the band. There was for a time even a slice of the 420-460Mc/s allocation given over to these SEO requirements. It didn’t stay long because SEO didn’t stay long, for in spite of the technical difficulties the determination existed among the fraternity to persuade frequency-stabilised transmitters and converters to function at 70cm.

Note in the preceding paragraph the use of "Mc/s," the then current term used in the technical literature of the time. "Megahertzes" hadn’t come in back in 1953, around which year our story revolves. Other developments which “hadn’t come in” included proper FM — not the inadvertent FM produced by self excited gear — and solid-state technology (the transmitter had been invented but UHF devices were a decade away). As for repeaters at 70cm, they were two decades away!

Power Triplers

For experimenters resolved to get going on 432Mc/s (that term again!) the most promising route seemed to be by the use of an 832 twin-tetrode, known to be a good performer at 144Mc/s but with merits unknown at 432. This valve had come across the Atlantic in great quantities during the war (only eight years before) as a popular final stage in the American radio-telephone equipments of the day used by the fighting services.

Before long the 832 could be had for as little as what was then known as ten bob (meaning 50p today) from many a war-surplus equipment dealer. Studying its characteristics, and notably its inter-electrode capacitances, those experimenters of the early Fifties wondered whether the thing could ever be persuaded to deliver RF in any quantities at 432. Persuaded it was, usually by the process of clobbering it with plenty of RF at 144Mc/s in the hope that it could be bludgeoned into tripling to 432. And indeed it was.

The limitations of the 832 at 432 became all too evident, but "...that’s the best we’ve got" was the philosophy of the times. A characteristic mechanical layout which was favoured is shown in the sketch at Fig. 1. Utilising two 832 valves, it disposed one of them vertically on a suitable chassis to perform as a 144Mc/s amplifier, its anode inductor extending horizontally from it and close coupled with a similar inductor connected across the twin input grids of a second 832. This second valve was disposed horizontally and functioned as a power tripler, 144 in and (hopefully) 432 out. The magic moment came when an apologetic trickle of RF emerged from the tripler’s twin anodes, just enough to light a flashlamp bulb.

When using the 832 it was important to allow for the different co-efficients of expansion between its glass bulb and the metal connectors attached to its top pins. If you didn’t, there was a pop, followed by the tell-tale grey suffusion within the bulb to show that air had entered it. “You see a ham in mourning” was said probably more than once as an experimenter displayed a defunct 832 to a sympathetic spouse.

Help was at hand. It was called the QQV03/20. Like the 832 it was a twin tetrode, but immensely superior in its ability to loaf along safely at frequencies far above 432Mc/s. It too was “prone to pranging” via the metal to glass expansion, but before long it was improved by being given a sintered top that rendered it almost impervious to even the roughest wrenching that
might be applied to the pins by pliers. Not that knowledgeable hams would do such a thing, but less dedicated users might, and there was an increasing number of them around in the burgeoning professional mobile field where existed the primary purchasers of valves like the 3/20A. A ham had to think many times before he assigned the best part of a week’s pay to one!

Like the 832, the new “Three Twenty” allowed the use of long-line inductors for tank coils, sometimes tuned in parallel but often tuned with a butterfly trimmer across the remote ends: you lumped less capacitance across the system and made the lines longer and more efficient if you did it this way.

Such developments virtually put an end to the use of SEO transmitters and super-regen receivers (though these remained in use for a while as an approach to microwaves).

**Feeding and Care of Aerials**

Having generated your 432Mc/s RF and amplified it via a 3/20 to a level of seventy-centimetric power hitherto unheard of, you were next faced with the problem of getting it to the antenna and away into space. This was not easy: the RF cables of the time came largely from the television aerial industry which at that time wasn’t interested in frequencies much above 60MHz, although before long the cable industry was compelled to address itself seriously to the needs of the new TV broadcasting service about to start up around 200MHz (in the mid Fifties) but also to the increasing needs of the mobile industry.

Before this happened hams were faced with a very limited choice of co-axial cable suitable for their 432MHz band. Some of the ex-wartime stock could be pressed into service, but the widespread doubts among hams about the efficacy of low impedance coaxial cable was expressed in a considerable interest in open-wire feeders — yes, even for 70cm. But this, like the super-regen, didn’t last long when better coax became available.

As for the aerial itself, there was much debate about the merits of stacked arrays (sometimes with reflectors to give them a measure of directivity) and of long Yagi designs.

Eventually, the Yagi won, although it induced in the minds of many the thought that if you put a lot of elements on it you would increase the range and maximise your hard-won RF energy. From this line of thinking grew the “super long Yagis” so much the fashion a few years ago but now less popular (a) because the few extra decibels they provide do not warrant their size and loading on the average amateur mast and (b) because the extreme directivity compels you to rotate yours much more than you would a smaller array that gives you more idea of what is happening off the sides.

**The Self-Help Ethic**

One third of a century ago ham radio aerials of whatever sort were home-built. So was everything else in a 70cm installation at the end of a feeder line. This self-help ethic had it’s lighter moments.

For instance, there was the enthusiastic who formed a queue of one outside a loudspeaker maker’s factory knowing that redundant metal grilles were often thrown out and could be had for the proverbial song, for use as mesh reflectors for aerials. He refused to be daunted when told by a professional electronician that he couldn’t expect much more than 1db of gain if he did it that way.

Another experimenter who had heard of a peculiar device called the Kolster tank (it appeared to combine the advantages of lumped and cavity inductor) decided he would “go into production with it”: he was in charge of an industrial model shop so had facilities in that respect. But the primary value of this device was to provide a good Q for super-regen tank circuits. When super-regens went out so did the Kolster tank. It ought to be added that a further death-knell to self-excited rigs was sounded when DX deep into the heart of Europe was reported by users of stabilised transmitters — and you couldn’t work that with an SEO.

Yet another 7cm pioneer upon receiving a social visit from a professional electronics friend invited him to the shack to see the band in action. The professional took one look at the equipment the enthusiast had built and said: “I just don’t believe it!” His disbelief turned to respect when a 70cm station 40 miles away came back to a CQ call and gave S9.

Many other examples of self-help in action could be quoted from those times. Underlying them all was the radio ham’s traditional delight in attacking many an apparently intractable problem simply “because it’s there,” commonly called the Everest Syndrome. That ethic is still around today even though amplitude modulation and “keying the screen,” common practices in the Fifties, and not heard of in the metrewaves of the Eighties.

Only the most prescient of those days could forecast the onset of transistorisation and the emergence of devices capable of working well not only on 70cm but higher up still in frequency. Still, it was good fun and its pioneers would not deny today’s operators the pleasure of using the band under almost idealised conditions. They do it themselves!
1 Jan  Sutton & Cheam RS: Natter night.

4 Jan  Todmorden DARS: Construction competition.
              Sheffield ARC: 'Open Forum' (brainstorming session).
              Firth Park Pavilion, Firth Park Road, Sheffield 5.
              Meetings start at 8.00pm.
              (RAE & Morse between 7.00pm & 8.00pm).

5 Jan  Fylde ARS: AGM.
              Delyn RC: Informal Meeting.
              Rugby ATS: New Year natter night.
              Chester DRS: AGM.
              Wakefield DRS: Night on the air.

6 Jan  S Bristol ARC: Cine film evening.

7 Jan  Bredhurst RTS: Talk 'Phase Lock Loops' by Steve G8NVH
              Yeovil ARC: Talk 'Contest Operating' by G3GC
              Salop ARS: Equipment bring and buy.
              Horsham ARC: Talk 'Planning applications' by G3UDU
              Vale of Evesham RAC: Slides 'A year in the life of VERAC' by Martin G6TRS
              East Kent RS: Old-timer panel. 7.30pm. Parkside Lodge, Kings Road, Herne Bay.
              Info from Brian Didmon, G4RIS. Whistable 26042.

8 Jan  Itchen Valley ARC: Talk 'A Low Cost Panoramic Receiver' by Andrew G4XZL.
              Wimbledon ARC: 'Bring & Test Your Own Equipment' Herbert Rd, Wimbledon, London SW19
              Info from David Love (0737) 81559.

10 Jan  Sunderland ARS: Sale of Surplus Equipment.
              Porcupine Park, Queen Alexandra Rd, Sunderland.
              Doors open at 11.30am; viewing at 12pm and auction starts at 12.45pm. Bar refreshments available.
              Talk in on S22. More details from Nigel Maraton, GOASM on (091) 5288079.

11 Jan  Atherstone ARC: Club night.
              Sheffield ARC: Talk 'That's China' by Tony Whitaker (G3RLK).
              Firth Park Pavilion, Firth Park Road, Sheffield 5.
              Meetings start at 8.00pm.
              (RAE & Morse between 7.00pm & 8.00pm).
              Info from Alan Pemberton, GOILG (0742)395 287.

12 Jan  Rugby ATS: Construction corner.
              Keighley ARS: Natter night.
              Wakefield DRS: Debate.
              Worksop ARS: Natter nite.
              Verulam ARC: Talk 'Standing Waves' by Gerald Stauncey, G3MCK.
              RAF Association HQ, New Kent Rd, Off Marlborough Rd, St. Albans.

13 Jan  S Bristol ARC: Bring & Buy.
              Wirral DARC: AGM.
              Willenhall DARS: CW night. 8.15pm. Cross Keys Inn,

Ashmore Lake Rd, Willenhall, W. Midlands. Info — Dave Jackson, G0EGG (0902) 734475.
Farnborough & DRS: Film Night by G4MBZ. 7.30 for 8.00pm. Railway Enthusiasts Club, Harley Lane, Farnborough.
Further details from Tim Fitzgerald (G4UQE) on Camberley 29231.
Southgate ARC: Talk 'The History of Satellites' by Richard Limebar (G3RWL).

14 Jan  Edgware DRS: AGM.
              Yeovil ARC: Talk 'Producing Aerial Gain' by G3MYM.
              Bredhurst RTS: Construction & natter night.
              Salop ARS: Special event station GB2SSJ on air (Salop Silver Jubilee).

15 Jan  Sutton & Cheam RS: Talk 'Air Spaced Capacitors' by Malcolm Kirk (G4XMK).
              Coventry ARC: Committee meeting.
              Firth Park Pavilion, Firth Park Road, Sheffield 5.

18 Jan  Todmorden DARS: Natter Night.
              Bredhurst RTS: Slide competition with Parkwood Photo Society.
              Sheffield ARC: Committee meeting.
              Firth Park Pavilion, Firth Park Road, Sheffield 5.
              Meetings start at 8.00pm. (RAE & Morse between 7.00pm & 8.00pm).

19 Jan  Delyn RC: Informal meeting.
              Wakefield DRS: Mastermind.
              Halifax DARS: Talk 'RAYNET' by David Holdsworth (GBCG).
              Fylde ARS: Informal evening.
20 Jan  S Bristol ARC: HF Activity Evening.

22 Jan  Coventry ARS: Talk/Demo: 'Packet Radio.'
23 Jan  Wakefield DRS: Annual Dinner.
26 Jan  Keighley ARC: AGM. Wirral DARC: Surplus equipment sale. Wakefield DRS: Talk 'Stateside' by G1FOC. Itchen Valley ARC: Talk 'Wireless from the beginning' by Peter G3CBU.

27 Jan  S Bristol ARC: Club Project — construction evening.
29 Jan  Bredhurst RTS: Christmas dinner & dance.
31 Jan  Belle Vue/Norbreck Radio Rally. Norbreck Castle 4th time to put the roast in! "Thanks for the contact, old man, but must go Q.R.T. — time to put the roast in!"

1 Feb  Todmorden DARS: AGM. Worksop ARS: Talk 'The history of amateur radio' by Ken Shearman, G1XLZ (0609) 775478.
2 Feb  Rugby ATS: Night on the air. Wakefield DRS: Night on the air. Workop ARS: Video night — 'Electromagnetic Wave'; 'The Electron's Tale'; Thin Film Microcircuits.'
4 Feb  Yeovil ARC: Talk 'A Simple Shortwave Receiver' by G3MYM. Bredhurst RTS: Talk 'How to Use a SCOPE' by Bernie Bowden GOENN. Salop ARS: Talk 'Model Steam Engines' by GOEBD. Horsham ARC: Talk — 'How linear is your linear?' by G3ZWT.
8 Feb  Atherstone ARC: RAE Course. Details — Ken Shearman, G1XLZ (0609) 775478.
Got an FT290 or similar and want to get onto 6m without breaking the bank? A deluxe solution would be to buy a separate rig for the band, alternatively for those on a tighter budget you could plug a transverter in line and still retain all the operating features of your main rig, then £135 and £172 respectively for those who, like myself, dread the thought of chassis bashing. 

A-Transverting We Will Go

For those new to the concept of a transverter, it is simply a ‘black box’ placed in line with your main rig which gives you a fixed frequency translation, or more simply a ‘shift’ between two amateur bands. In this case, you transmit on 144MHz and get 50MHz out, 145MHz in gives 51MHz out and so on, likewise on receive — but of course in reverse! Linear operation means SSB in gives SSB out and FM in gives FM out, so in effect many of the facilities your main rig such as modes, memories, IF shift and so on are translated onto the other band. The disadvantage of course is that your main rig is tied up driving the transverter so you can only operate one band or the other but not both at the same time. Also because the cleanliness of the receive and transmit signals are limited by the performance of your main set, further circuitry in the transverter can usually only degrade the RF performance of your system; whereas separate rigs are purpose designed to give the best performance possible within a pre-defined budget.

Offerings

The boxed 25W transverter was supplied for review to allow tests to be made on the complete arrangement, however many of the electrical features are common to both the low power and uncased options. The transverter operates from a nominal 13.8V DC power supply, drawing 4A maximum for the 25W version. The unit is suitable for use with 2m transceivers having between 0.5W and 3W pep RF output, an optional attenuator being available (at £22) for use with 10W 2m transceivers. The manual states that the unit may be modified if required to operate with input powers down to 1mW, real QRP drivers!

The frequency coverage is 50MHz-52MHz, corresponding to an IF of 144MHz-146MHz. A low noise BF981 FET front end gives a claimed noise figure of less than .25dB and a typical conversion gain of +6dB, with a –6dBm input inter-
cept point. On transmit, the all-important suppression of the second harmonic, falling in the middle of Broadcast Band II, is claimed as being better than -70dBc, with other surplus outputs being suppressed by at least 60dBc to save you having unwanted QSOs with, say, business radio users. For 194MHz, no less than five modes of Tx/Rx switching are allowed for with simple internal link changes, these being carrier (RF) derived with a fixed hang time of approximately 0.5sec, carrier derived with no hang time, DC voltage on coax inner on Tx, DC voltage on coax inner on Rx, and an external contact to OV on transmit. The instruction manual also gives details of component additions required to give a variable hang time, and interfacing details to allow use of the transceivers giving OV on transmit with 12V on receive from their accessory connectors.

The cased unit comes supplied with a 550mm long flying coax lead terminated with a PL259 plug to connect to your 2m transceiver, and a chassis mounted BNC socket for the 6m aerial connection: a 700mm long twin mains lead is provided for the DC supply.

**Impressions**

The transceiver is presented in a black painted case with a brushed aluminium printed front panel, and a glance at the internal photograph shows that a high standard of PCB construction has been employed. However the thing that I took an instant dislike to was the unfused mains-type power lead used. I have seen mains-type leads used on commercially produced 13.8V linear amplifiers, and I feel that this could lead to confusion regarding operating voltage. For the sake of saving a few pence, I feel this really lets a professional product down.

Having got that off my chest, I'm glad to see that several forms of DC switching such as this allows a faster transmit/receive change-over, as well as being essential if data transmission, SSB or CW is being used.

**In Use**

Apart from link changes to vary the Tx/Rx switching method, the only setting-up needed involves adjusting the internal drive potentiometer to match the main transceiver drive power. In the absence of a pep reading RF wattmeter, the instructions suggest that the potentiometer be initially set fully anti-clockwise, its most sensitive position, then rotated clockwise until the output power falls by 10-20% as shown on an external SWR bridge. This will ensure the final PA operating in its linear portion, and is in fact the method I have previously suggested for setting up a 6m amplifier drive sensitivity level (HRT Sept 86).

As supplied, the amplifier was set up to give 25W output for just over 2W input, so as my 2m driver output level was accurately set I proceeded to get on the air. To test the transverter, I used my FT107M/FTV107 multimode system using the 2m and 6m outputs, the 2m output being fed to the RN transverter with its output going to the aerial via a two-way coax switch. The other switch port was fed with the main set's 6m output, allowing a fast changeover to take place between transverter and 'direct' 6m working to allow a comparison to be made. I used a variety of aerials, right down to an indoor wire dipole as might be used by many newcomers to the band.

The first thing I noticed was an increase in receiver noise as the transverter was switched on, connecting an outdoor aerial well in the clear of surrounding electrical QRN increased the noise level again very slightly. An indoor aerial, in the proximity of TV line timebase emissions and the like, increased the noise level rather more, showing the ultimate sensitivity of the system was mainly limited by external noise and not by the transverter noise figure, hence you wouldn't need a masthead preamp unless your feeder was very lossy.

As would be expected, in listening to weak beacons such as GB3NHQ I found no difference in readability between the RN transverter coupled to my 2m rig and the normal 6m input with the coax switch changed over. I did find a slight increase in S-meter reading due to the receive gain of the transverter, and with no signal the meter needle hovered around the S1-2 mark.

On transmit, I quickly grew tired of using the RF switching facility, but more so than other transverters and linear amplifiers as the RN model seemed to need a bit more of a 'kick' of RF before it switched over, causing the odd syllable to be lost at the beginning of overs or after a
Close-up of PA heatsink mounted on top panel

pause in speech. The internal relays however were very quiet in operation, and did not detract from my QSOs, but the serious operator would certainly employ ‘hard’ switching. I received no reports of

'splattering' or distortion on my speech which is very good, showing the PA to be nicely linear.

One problem sometimes encountered when using a transverter is strong unwanted 2m signals being received when operating with the transceiver in line, with even the odd QSO resulting! Testing the RN transverter showed that even the local 2m operators in line of sight of my QTH were inaudible with the transverter plugged in, whilst by unplugging the transverter and leaving my 2m coax unterminated I could sometimes hear these 2m signals coming through, showing there was very little leakage indeed in the units circuitry. In all, a very good on-air performance.

**Insides**

The transverter is constructed in a diecast alloy box chassis, the majority of the circuitry being on a large double-sided PCB with the transmitter power amplifier housed in an RF-screened compartment fitted to the lid, the PA transmitter being bolted to a finned heatsink. On receive a 6m bandpass filter feeds the BF981 dual-gate MOSFET amplifier, its output being taken via a further bandpass filter to an SBL-1 diode ring mixer block. A 94MHz crystal oscillator operating from a zener diode stabilised supply is used to feed the local oscillator port of this mixer block, the resultant output passing via a 3dB attenuator and changeover relay to the 2m transceiver aerial connection.

On transmit, the RF is sensed by a diode detector feeding a transistor switching arrangement, a further circuit performing the coax inner DC switching input sensing, with the outputs driving a pair of changeover relays through a further bipolar transistor switch. The transmit input passes via a relay switched RF power attenuator and onto the 3dB attenuator and ring mixer common to the receive path, a further PIN diode controlled variable attenuator at this point providing a Tx gain control.

This arrangement unfortunately means that if transmit drive were applied to the transverter with no DC supply connected, the mixer could be fed with 1.5W of 2m, which would probably cause its untimely demise. The output of the mixer is passed through the 50MHz bandpass filter (again common to the receive path) while its output passes through a further relay to the transmit linear amplifier stages where the signal is amplified to the final RF power level.
Laboratory Tests

The receive conversion gain was measured at +4dB maximum and testing with a signal generator and spectrum analyser showed the unit had an excellent bandpass response with very little passband ripple. I was very impressed. Attempting to measure the 2m leakage was almost impossible as it was so low, the bandpass filtering in the transverter was certainly doing its job. The 1dB compression point showed the transverter strong-signal handling to be fairly reasonable — the use of a ring mixer mainly limiting this. There are several active FET mixers around with far better performance but these suffer from the expense of having greater circuit complexity.

On transmit, in checking the output spectrum I could only detect the second harmonic above the -90dBc level, the fourth harmonic was just visible above the -92dBc noise level, all other nasties were below this. Closing in on the 2m leakage by narrowing all the test equipment bandwidths down showed this to be suppressed by -98dBc, which is excellent. The PA linearity was very good at 50% output power, and still good at 25W pep-overdriving the input by 3dB gained around 1dB in output power but caused the higher order SSB sidebands to sharply increase in level.

Conclusions

The first thing I must say is that the transverter is not idiot proof, due to the lack of protection such as a DC fuse, the input circuit arrangement, and a lack of Tx ALC and high SWR power reduction, which means that users must be aware of what they are doing. Provided the instructions are followed closely however, a very good performance should result. I was pleased with the simplicity of use, especially the provision for several forms of Tx/Rx switching. The general RF performance was very good and the out-of-band suppression in particular was excellent. For the selling price of the basic PCB, I believe it will fill a well-needed gap in the market, and for those who would like a ready boxed unit the tested 25W version would also represent good value for money.

My thanks go to RN Electronics for the loan of the review transverter.
The main activity of most YL clubs is the production of a magazine, usually every two or three months. The magazine is regarded as a means of keeping members in touch with each other, so it contains items of personal news as well as details of YL contests and awards, news of other YL clubs and some general activity for most YL clubs. The American YL Club, YLRL, now organises no less than five different contests - most of them, unfortunately, "YL only," which makes them somewhat unpopular with the rest of the amateur population. As for other contests, the general pattern seems to be "Anyone may participate - YLs work anyone, OMs work YLs only." While some clubs - notably the American ones - tend to go for full-blown all-band marathons, the smaller groups - including BYLARA and the Dutch YL Club - have opted for short contests with operation restricted to just one or two bands. The Dutch contest is 2m only (who needs HF in such a tiny country!), while the BYLARA contest, held over two 3-hour periods on a Thursday evening and Saturday morning respectively, has separate VHF and HF sections, with HF operation being limited to small segments of the 80 and 40m bands.

One nice thing about YL contests is that, compared to other contests, they seem a lot more friendly, informal and relaxed. It seems that YLs take contests with a pinch of salt, and participate in them in order to have fun, not in order to win. Although reports and serial numbers get thrown around just as often, YLs will usually find time for a quick word - and it's amazing how the odd "nice to speak to you again" or "give my regards to..." can make all the difference to the general feel of a contest.

Useful dates
Three contests coming up in the winter months will be the BYLARA Contest on February 25th and 27th, the three-hour German YL Contest on March 14th and, before that, the Midwinter Contest, organised by the Dutch YL Club (DYLC) on behalf of a consortium of four European clubs, with a CW section on Saturday January 9th and a phone section on Sunday January 10th. Unfortunately, the future of the Midwinter Contest is somewhat uncertain at the moment due to internal problems within the DYLC, but I expect that these will have been resolved by the time you read this.

For those wishing to take part in any of these contests - full details are available from me, at the address given below.

Awards
A number of awards are available for working YL stations - a directory published in 1985 lists no less than thirty-nine, ranging from the prestigious YL DXCC (available on the same conditions as the "ordinary" DXCC award, but for YL contact only), down to local awards requiring QSOs with a specified number of YLs from a particular town or region. Some awards prove more of a challenge than others and one of these is the Grandmother Award which requires contacts with ten grandmothers! With this award there is also a special endorsement for working operators who are great-grandmothers.

A YL award for the new year is the "YL Year 1988 Award."

Angelika Voss, G0CCI, takes us on a tour of the latest '5% news,' introduces a few contests with a difference and has a go at YL critics!
This is to certify the outstanding achievement of amateur radio station G5CCL in obtaining the requirements necessary for this award.

signed date award no. 47

The BYLARA award certificate

sponsored by the Dutch section of the international award hunters' club, DIG (which apparently stands for the group's German name, Diplom Interessen Gruppe). For this award, applicants must obtain 88 points by either working 8 YLs during each of 11 months, or working 11 YLs during each of 8 months. Special bonus points are gained for working YLs on February 29th, and these may be used to make up for QSOs missed during other months. As you can see many of the awards are aimed at enjoying the hobby rather than starting a QRO rat race! BYLARA now sponsors two awards, the original BYLARA award which requires contacts with 15 members (10 for applicants outside Europe), and the newly-launched Scottish YL award for working BYLARA members north of the border.

Meetings

In addition to publishing magazines and sponsoring contests and awards, most YL clubs also arrange members meetings. In some cases, these can be major events – conventions of the American YL Radio League regularly attract in excess of 100 people, and the 30th anniversary party of the Japanese YL club last September was attended by visitors from as far afield as Thailand and the USA. By comparison, BYLARA meetings have been fairly small and informal affairs so far, often taking the form of impromptu gatherings at rallies rather than organised meetings. Annual General Meetings are normally held at rallies too – although the specific venues have ranged from a proper lecture room at the VHF Convention to a group of chairs round the BYLARA stand, and have included a boiler room at Leeds and a glorified cupboard at Birmingham NEC!

"Heck, no, you didn't disturb me..."
"I should marry her. She's the only one who knows all about Resistors, Capacitors, Transistors and Inductors."

Divisive BYLARA?

Talking to people at rallies, I sometimes get asked why I chose to become involved with a YL club and a comment frequently heard is something like: "Isn't it all rather sexist?" Some people have gone so far as to say that YL clubs are harmful to the spirit of amateur radio, as they seem to be segregating female amateurs from male ones, thus creating barriers where there shouldn't be any.

To some extent, such criticism may be justified – or it would be, if people decided to join YL organisations instead of becoming members of their national society or local club, which fortunately, is not usually the case. The majority of BYLARA members also belong to the RSGB and many are actively involved in local clubs or other organisations such as RAYNET.

A YL club is simply a group of people who have one more thing in common besides being radio amateurs. There are clubs for those who share a common profession or affiliation to a military organisation, for amateurs who share the same ethnic origin (the Ex-G Radio Club), for those who have other hobbies in common, and even for people who have been licensed longer than others or who hold more than a certain number of awards! No one has ever suggested that there is anything strange about organisations like RAFARS or the Radio Amateurs’ Old Timers’ Association – so is there really anything wrong with an organisation which brings together radio amateurs who are female?

Closing stages

There is always a good deal of cooperation amongst YL clubs and operators and I would especially like to thank Louisa Sando, W5RZJ of CQ YL for allowing the use of the historical material which appeared in the last ‘5% Column.’ Also here is a reminder of the YL asked times for 80m: Mondays at 1915 local time around 3.688MHz for the BYLARA net and Wednesdays at 2000 local time around 3.65MHz for the European YL net. Both of these nets are open to all and new voices are always welcome.

Same Box – Different Town

Please note that, although the box number for correspondence has not changed, the postal town has. As always comments, queries and contributions are always welcome but please enclose an SAE if you would like a reply. The address is: PO Box 49, Manningtree, Essex. CO11 2SZ.

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YT CONTESTS – WINTER 1988

Please mention HRT when replying to advertisements.
One of the most versatile VHF valves ever to be invented is the QQV03/10 twin tetrode, variously known as the QOE3/12 in its Dutch derivative, the 6360 and the TT24 (all are identical). All require 12.6 volts heater potential — 6.3 volts if you parallel the heater sections, plus an HT power supply unit for delivering 300 volts at around 100mA. Pin connections for the valve are shown in Fig.1. The 'Three Ten' may be utilised as a power amplifier in a VHF transmitter or as a frequency multiplier in various configurations. It has even been known to operate in audio applications, when it will deliver ten hefty watts to a loudspeaker system.

But first of all, what of the availability of this particular valve, and isn't it rather passe to dabble in valve circuitry in this day and age of almost universal transistorisation? Answers to both doubts are:

**Jack Hum, G5UM, talks about a well-known and versatile VHF valve and its uses — including a rarely seen push-push doubler circuit.**

The QQV03/10 is in plentiful supply if you know where to look. You do not need to purchase your 3/10 new, as prices tend to be a bit on the high side. With the rally season in full swing, search out old radio-telephones going for a song, peep inside them and if you track one down that includes one or more 'Three Tens' snap it up. While you are about it try to obtain at least two samples in accordance with that well known law that if you have two of everything you will never need the spare, but if you don’t, you will.

Valve circuitry; it still has much to offer the constructor in spite of the sway of the transistor (perhaps because of it; see next paragraph!). For one thing, there is the little matter of 'visibility': you can readily see what you are doing when you go about wiring up a valve circuit. For another thing, there is the valve’s inherent ruggedness: you need to be really hamfisted to ruin it. Unlike the transistor — the fastest fuse known to man — a valve will stand an enormous amount of punishment before it goes blue in the electrodes and finally expires. Then there's the very important factor of:

**Docility;** valve RF circuits are easier to stabilise than transistor ones. Many an amateur-built transistor PA unit has been consigned to oblivion (or the garbage can) simply...
Fig. 3 How a QQV03/10 push-push doubler delivers output at either 50MHz or 70MHz. Valve V1 is a conventional Colpitts crystal oscillator or a VXO using a 12.5MHz crystal for 50MHz or an 11.7MHz crystal for 70MHz, anode inductor L1 tuned to second harmonic for 50MHz or third harmonic for 70MHz. Output is symmetrically balanced by C2 to give symmetrical input to the twin grids of the 3/10 via L2. The output of the 3/10 doubler is balanced by C5 to give symmetrical input into a following load, which may be either a PA stage or antenna.

Fig. 4 How the 3/10 push-push doubler may be fed directly into an antenna via a coaxial relay. Two turns of thick wire are introduced into the centre of the doubler output indicator, one end grounded, the other end soldered to the centre conductor of the coaxial relay positioned in the immediate vicinity of L3.

**ALIGNMENT PROCEDURE**

1. Select required harmonic developed in L1 by V1 by adjusting C1 for maximum drive indicated at TP1 (Test Point 1), probably 0.3 to 0.5mA.
2. Adjust C4 to resonance at 50MHz (or 70MHz as required) as indicated by maximum current indicated on a milliammeter connected to TP2 (Test Point 2).
3. Insert iron dust core into L4. If drive indicated as TP2 increases, squeeze turns closer together, because L4 has not been made big enough.
4. Insert brass core into L4. If indicated drive increases this means that the coil is slightly too large: increase spacing between turns until maximum drive at TP2 is achieved.
5. Finally, maximise the coupling of L2 with L1 and L3 with L4 until maximum current is achieved at TP2. This could be 2mA or more.

**NOTE:** At all times check that the correct harmonic has been selected in L1 and L2, and in L3/L4 by using an absorption 'RF sucker'.

on account of the constructor’s inability to tame it and his reluctance to face the design and fabrication of the elaborate tank circuit filtering, essential to render the device sanitary and free from spurious products.

**A Good PA**

The searcher for Three Tens at rallies will doubtless unearth some of those early hybrid PMR transceivers that utilised solid-state devices in their earlier stages and a 3/10 in the final, designed at a time when transistors capable of providing today's high levels of RF had not been developed. In such equipment the 3/10 found a ready place as a 'natural' PA in spite of the fact that a high voltage generator would be needed to run it.

In amateur applications too, the Three Ten is a natural. For instance, it would substitute admirably for the 3/20A specified in the 'Simple Sender for Six' described in HRT in November 1985, although RF output would be slightly down. In this application the valve will deliver, for only a quarter-of-a-watt of drive, something like 14 watts of RF energy in a 50MHz or 70MHz transmitter design.

Having referred to the 3/20A and the 3/10 in the same paragraph, it is important to emphasise that the former is generally easier to tame than the smaller 3/10 simply because layouts incorporating the 3/20 have grid input circuits and inductors well removed from anode output units, separated by the screening of the chassis on which the 3/20A sits.

This advantage does not occur with the QQV03/10, all of whose pins, inputs and outputs, are close together around its B9A periphery. If grid input inductors can see the anode output inductors, self oscillation will ensue and the constructor may be momentarily puzzled why his new built sender continues to indicate output when the crystal is pulled out of the socket of the crystal oscillator stage!

So a good solid screen across the base of the 3/10 then, high enough to blank off input from output inductors, and well earthed down to chassis.

Given moderate care in the construction of such a PA unit the experimenter should experience no problems from what after all is a...
fairly 'trad' configuration. Now on to something much less 'trad':

**Ever Tried 'Push-Push'?**

Now to the first bit of unusual circuitry referred to in the introduction. It is a push-pull doubler, where input is applied in push-pull to the twin grids of the 3/10 but output taken from the strapped anodes. The amount of RF punch to be obtained from this method is considerable, and one is constantly amazed that few amateur transmitter designs have advocated it.

The push-pull doubler's efficiency arises from the fact that it receives two 'thumps' of RF into its own two grids and combines these to deliver one massive thump from its paralleled anodes at twice the frequency.

The block diagram in Fig.2 shows how a push-pull doubler may be driven by a conventional variable crystal oscillator or by a straight crystal osc. For 6 metre operation the second harmonic of a 12.5MHz crystal is extracted from the oscillator anode circuit and applied to the push-pull grid input of the QQVO3/10, while for 4 metre operation the third harmonic of an 11.7MHz crystal is extracted. The paralleled anodes of the 3/10 then provide output at 50MHz or 70MHz as required. Strapping the anodes of the 3/10 will unbalance the circuit, simply because its twin, normally push-pull configuration is push-pull no longer. To render the push-pull output symmetrical the small capacitor C5 in Fig.3 balances everything up again.

The output yielded by the push-pull doubler may now be applied to whatever final stage the constructor has in mind, such as a QQV03/20A. *But it need not be applied to a final stage at all:* instead, it can be fed directly to an antenna to give a two-valve sender for either band, representing almost the ultimate in small size using valve circuitry as it could easily be accommodated on a chassis measuring no more than 6" by 2". It will furnish two or three watts of output, which, used with a reasonable beam aerial, will provide UK-wide coverage in the CW mode.

A two-turn indicator introduced into the centre of L3 will take RF power to the aerial, as shown in Fig.4, and the aerial changeover relay derives its 12V DC supply from the 12.6V AC heater rail via a small rectifier. And as for CW, where to key? Why, in the screen lead to the push-pull doubler, via a keying relay, remembering that this lead is 'hot' to HT. To render it 'cold' to RF, suitable small by-pass capacitors are included either side of the keying relay.

**Other Applications**

Rather more conventionally, the QQV03/10 may be employed as a tripler, as follows:

For the 4 metre band:

VXO or CO, 11.7MHz crystal input, 23.4MHz anode output. 3/10 tripler, 23.4MHz input, trebled output at 70.2MHz.

For the 6 metre band:

VXO or CO, 8.35MHz crystal input, 23.4MHz anode output. 3/10 tripler, 16.7MHz input, trebled output at 50.1MHz.

This ubiquitous valve will also function as an oscillator — at least, one half of it will. Most constructors would regard this as rather a waste of a good 'bottle' when something much more modest (and less thirsty) such as the EF91 or E180F would do equally as well.

Yet a rather elegant transmitter arrangement for those with 'Three Tens' to spare (admittedly not many persons!) would be to use three of them in a row, the first as a variable frequency crystal oscillator, using one half of it, the second as a push-pull doubler or push-pull tripler, and the third as the final power amplifier. Just something to think about!
FOR SALE

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HAM RADIO TODAY FEBRUARY 1988
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<tr>
<td>Address</td>
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<th>ENTER YOUR ADVERTISEMENT HERE:</th>
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<th>EUROPE</th>
<th>MIDDLE EAST</th>
<th>FAR EAST</th>
<th>REST OF THE WORLD</th>
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<tr>
<td>A&amp;B Computing</td>
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<td>Aeromodeller</td>
<td>£27.00</td>
<td>£27.20</td>
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<td>Citizens Band</td>
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<td>£21.80</td>
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<td>Clocks</td>
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<td>£32.60</td>
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<td>£20.20</td>
<td>£20.40</td>
<td>£22.30</td>
<td>£20.70</td>
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<tr>
<td>Which Video?</td>
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<td>£19.50</td>
<td>£21.20</td>
<td>£19.80</td>
</tr>
<tr>
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<td>£25.70</td>
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<tr>
<td>Your Commodore</td>
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<td>£25.20</td>
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<td>Model Railways</td>
<td>£19.10</td>
<td>£19.30</td>
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<tr>
<td>Practical Wargamer</td>
<td>£7.10</td>
<td>£7.20</td>
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RECEIVE 70-700 MHz
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The high performance, low cost system
For VIC20 we have our RTTY/CW transceive program. Tape £20.

RX-4 RTTY/CW/SSTV/AMTOR RECEIVE

This is still a best-selling program and it's easy to see why. Superb performance on 4 modes, switch modes at a keypress to catch all the action. Text and picture store with dump to screen, printer or tape/disc. An essential piece of software for trawling the bands. Needs interface. BBC-B/Master, CBM64 tape £25, disc £27. VIC20 tape £25. SPECTRUM tape £40 inc. adaptor board. The SPECTRUM software-only version (input to EAR socket) is still available £25.

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technical software (HRT)
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Tel: 0286 881886
A GOOD DEAL ALWAYS MAKES SENSE

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★ 30 watts Output Power
★ Suitable for 1 or 3 watt Transceivers
★ Linear all Mode Operation
★ Straight Through Operation when Turned Off
★ Ultra Low Noise Receive Preamp – Front Panel Selectable
★ Equipped with RF VOX and Manual Override
★ LED Status Lights for Power, Transmit & Preamp on

FEATURES
★ 100 watts Output Power
★ Suitable for 1 or 3 watt Transceivers
★ Linear all Mode Operation
★ Straight Through Operation when Turned Off
★ Ultra low noise receive preamp – front panel selectable
★ Equipped with RF VOX and manual override
★ LED status lights for power, transmit & preamp on

FEATURES
★ 25 watts TX output
★ GaAsFET RF stage
★ Transmit ALC circuit
★ 13.8V DC operation
★ Repeater shift (Simplex, Normal, Reverse)
★ High level double balanced receive mixer
★ LED bargraph power output indicator
★ RF VOX – adjustable delay – PTT override

FEATURES
★ ALC Range 20dB
★ Noise figure better than 3.8dB
★ FM SSB FSK AM Capability
★ SO 239 50 OHM Input & Output Connectors
★ 20 watts Output Power
★ 144 or 28 MHz Input I.F. Range
★ Full 50-54 MHz Output
★ 150mW - 15 watts Input Power
★ MML 144/30LS £98.90 + P&P
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Telephone: 051 523 3011 Telex: 628608 MICRO G
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