40p

The SHORT WAVE Magazine

VOL. XXXVII MARCH 1979 NUMBER 1

THE FABULOUS ICOM IC-701!

the systems approach!

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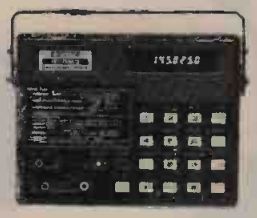

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SHORT WAVE MAGAZINE

(GB3SWM)

ISSN: 0037-4261

Vol. XXXVII MARCH, 1979 No. 425

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Editor: **PAUL ESSERY, G3KFE/G3SWM**

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Published at 34 High Street, Welwyn, Herts., AL6 9EQ, on the last Friday of the month, dated the month following. *Telephone: 04-3871 5206 & 5207*

Annual Subscription: *Home: £5·50, 12 issues, post paid*
Overseas: £5·50 ($10·00 U.S.), post free surface mail

Editorial Address: **Short Wave Magazine, 34 High Street, Welwyn Herts. AL6 9EQ, England.**

Prices shown in advertising in this issue do not necessarily constitute a contract and may be subject to change.

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E. & O. E. VAT Reg. No. 239 4864 25

FOR THE RADIO AMATEUR AND AMATEUR RADIO

The SHORT WAVE Magazine

EDITORIAL

New Volume

We come to the start of a new volume of *Short Wave Magazine* after a somewhat difficult period; but we do not intend to let that episode upset our intention to make each volume more interesting than the previous one.

We see now developments in amateur radio which we could hardly have foreseen even two years ago, when we first sat in this chair. The 'experimentation' part of our hobby has been largely swamped by the widespread use of commercial gear, both at VHF and HF; but there is still an enormous amount to be learnt about propagation in both areas, not to mention in the matter of increasing *effective* communication, in the sense of realising that there are times for CW, for SSB, for RTTY, and even for FM, and the operator's correct use of the modes available in his station in the light of band conditions at the time.

Much remains to be learnt, and much remains to be understood. Here we shall see increasingly the influence of the microprocessor and the microcomputer at work—set up to tell us by reaction to the receiver output which mode is best, and maybe even defining the minimum power output required to effect communication with a given part of the world. Likewise, on all bands there is still much to be done, achievable by amateurs, in the way of improving the receivers, transceivers and transmitters.

What about aerials? The aerial system of the average amateur station can only be described as pathetic, at least in the UK; partly planning-permission problems, but more for want of knowledge or effort.

Let us hope that 1979 will see a resurgence of all forms of experimental activity on *all* our bands, from Top Band right up into the microwave bands.

G3KFE.

VHF BANDS

NORMAN FITCH, G3FPK

Awards News

TWO metre VHFCC certificate no. 307 has been awarded to Mr. V. T. Williams, G8OGA, from Kitts Green, Birmingham. His interest in our hobby dates back to 1935 but the intention to apply for an "Artificial Aerial" licence in 1939 was thwarted by Hitler's War. After Army service, *s.w.l.* activities continued and the R.A.E. was finally taken in May, 1977, the call being obtained in September. G8OGA's first station comprised a *Yaesu* FT-221R and 5-ele. *Yagi* of the "crossed" variety. The present equipment is a *Belcom* Liner-2 with PA3-type Rx amplifier, audio compressor and 8-ele. horizontal *Yagi*. The next goal is to go for the Morse test.

Beacon Notes

High winds a few weeks ago brought down the aerials at GB3SU (ZN61a) which explains the silence on 70·695 MHz. It is not known when the beacon will be in service again. On 2m., the Wrotham beacon, GB3VHF, was closed down on January 25 on its old QRG of 144·150 MHz. After overhaul and the installation of a new keyer, its keeper, Brian Bower, G3COJ, hopes to have it operating again on the new frequency of 144·925 MHz by the time this appears.

Bryn Llewellyn, G4DEZ (Oxon.), heard what appeared to be a "private" beacon on 2m. around lunch time on Feb. 1. The QRG was 144·132 MHz and the identification, "DF1JC DL55d." Following comments in the previous issue about the near continuous use of 144·90 MHz by FM stations in the London area, the group concerned have now established their net in a more appropriate part of the all-mode section of the band. As more beacons are being shifted to the internationally agreed sub-band, it is to be hoped that users will keep the section 144·85 - 144·995 MHz clear of transmissions.

The Repeater Scene

The Peterborough UHF repeater GB3PB on RB10 now has new aerials comprising two sets of four stacked dipoles. George Pearson, G3AWZ (Somerset), suggests it would be most useful if, when 70 cm. repeaters are not being used as relays, they could be switched to beacon mode.

The recently commissioned Leicester VHF repeater on RØ (ZM24j) is a strong signal 180 kms. away at the G3FPK QTH, especially when the cross polarisation loss is taken into account. GB3CF must have a very good site! By contrast, the Norfolk repeater, GB3NB (AM36d) on R1, at a similar distance, is very weak.

The VHF repeater GB3HS on R2, serving the Hull area, is now licensed according to an item on GB2RS on Feb. 4, whereon it was suggested it would be operational soon. On Jan. 24, the aerial of the Buxton repeater, GB3HH, on R4, was blown down. The repeater remained operational but with a much reduced coverage until repairs can be effected.

W.A.C. on Two Metres

Congratulations to Dave Price, GW4CQT, who has now succeeded in Working All Continents on 2m. The last QSO was with VK5MC in South Australia. All the contacts were via *E-M-E* except the African one with CN8CC which was a fortunate *Sporadic E* one on June 4, 1978. As far as can be researched, this is the first 2m. W.A.C. to be achieved by any amateur.

It has taken Dave just ten months to complete this challenging task. His first *E-M-E* contact was with W7FN, but he has now worked some 30 W's *via* moonbounce. The South American QSO was with Edgar Mueller, YV5ZZ. Two Asians were worked; JA6DR and JA9BOH, and in Europe, SM7BAE. The receiving set up uses the *Trio* TS-700 with a 2 dB *noise figure* masthead preamplifier and a 2·4 kHz bandwidth. Dave has built a 160-ele. colinear array, 36ft. wide and 27ft. high which was used for the VK contact. Prior to that, the array consisted of four 7-ele. *quads*. The gain of the colinear array is 27 dBi. The 2m. country score is now approaching 50; a truly remarkable performance—and it's British!

Satellite Matters

Ron Broadbent, G3AAJ, the secretary of AMSAT-UK, has still not received the 1979 orbital calendars for *O-7* and *O-8* from the U.S.A. At considerable expense, he has been sending out *Xerox* copies to members on a monthly basis. AMSAT-UK will be issuing its own calendar for *O-7* and *O-8* in time for the Alexandra Palace exhibition in May and they will run for twelve months from then. As this is being compiled, calendars for the Russian satellites are being printed, initially covering through April. Thereafter, since over 2,000 orbits will have been completed, the aim is to produce a twelve month calendar based upon very accurate observed periods.

Although a couple of batteries in *O-7* are defunct, the Mode "A" transponder is still working quite well. On Mode "B" Pat Gowen, G3IOR, mentions a "reverse a.l.c. effect," whereby a strong signal makes the satellite's receiver *more* sensitive. The telemetry on 29·502 MHz is quite strong but meaningless, unfortunately.

A further AMSAT net has been organised for the 2m. band. This is on Sunday mornings at 1100 local time on 144·280 MHz in the Norwich area with G8IFF at the helm. Satellite users, or prospective users, are well advised to join AMSAT-UK. A stamped, addressed envelope to G3AAJ at 12 Herongate Road, London, E12 5EQ, will bring full details of all services and supplies to members.

The latest news of the Russian satellites, which were launched with the *COSMOS-1045* satellite on October 26, 1978, is that RS-2 has already "lost" one battery. It is not planned to operate its transponder. Its TLM Tx will only be switched on for monitoring purposes when in range of Moscow. As the orbits have been largely in the dark recently, the batteries have not been

receiving much charge. Accordingly, *RS-1*, which is scheduled to operate in transpond mode only on Saturdays and Sundays, has not been on during every orbit. Incidentally, the Russians use Moscow Time so that Saturday and Sunday is from 2100 GMT on *Friday* to 2100 GMT on Sunday.

The most recent orbit parameters given by AMSAT-UK being the pooled figures from many observations in several countries are:—*period;* 120·39028 *minus* 1·38 x 10^{-6}N in minutes. *Increment;* 30·227117 *minus* 3·467 x 10^{-7}N degrees west per revolution, where "N" is the orbit number. This refers to *RS-1* and a reference orbit for Feb. 5 was given as no. 1218 at 00h. 30m. 41s. GMT at 29·8°W.

A number of readers have been asking about the RS-type TLM heard on 29·351 MHz. Leo Labutin, UA3CR, says this is the *RS-3* Tx undergoing tests on a block of flats in Moscow. The Tx runs 200 *milliwatts* to a ground plane aerial. It has been surprisingly strong in London at times.

Anyone with access to a "PET" computer can obtain a "C-30" cassette containing a programme for any circular satellite orbit of the *Oscar* or *RS* type, enabling predictions to be made. For details, send an *s.a.e.* to G3AAJ.

It seems that the launch date for the first of the AMSAT "Phase III" satellites changes from month-to-month. The latest offer is now January/February, 1980. It seems that delays in the *Arianne* system are partly to blame.

News from Germany

DL1CU has sent Edgar Brockmann's, DJ1SB, detailed report going back to last October. The spell of good tropo. conditions we enjoyed on 2m. in mid-November were obviously very wide-spread From Germany, they seem to have worked everything from GM to HG and F to OH.

On the MS scene, Christoph Petermann, DB5YD (EL02e), heard G8JHL and GW4GSS on randon SSB during the *Quadrantids* on Jan. 3, as well as EA3XT. During the *Aurora* on Nov. 25, he lists QSO's with GM8NCM, GM8OVN, G8JHL, G3YSG and GM8LHE between 1437 and 1519 GMT, all SSB. DC8BB (EL24) completed an *Ar* contact on 432 MHz with SK6AB (FR30). In this event, DF2ZC (DK50d) completed QSO's with GM4BYF, G3AWL, G3ZCE, GM6XW, G4FUT and GM4EZJ/A.

Edgar's report mentions all the VHF/UHF/SHF contests for 1979 and it appears their 24 hour events are from 1700-1700 GMT.

THREE BAND ANNUAL VHF TABLE
January to December 1979

Station	FOUR METRES Counties	FOUR METRES Countries	TWO METRES Counties	TWO METRES Countries	70 CENTIMETRES Counties	70 CENTIMETRES Countries	TOTAL Points
G4DEZ	—	—	52	15	—	—	67
G3FPK	—	—	52	8	—	—	60
G4ERG	—	—	43	9	—	—	52
G2AXI	13	1	21	1	3	1	40
G3FIJ	13	1	18	4	1	1	38
GM4CXP	2	1	19	11	—	—	33
G4HAO	—	—	28	5	—	—	33
GI8EWM	—	—	22	6	—	—	28

Contests

The Barking Radio and Electronics Society is running a four hour contest on March 25 from 1400 *local* time. This is on the 2m. band and there are two sections; one for those living in Essex, the other for the rest residing outside the county. Exchanges to consist of RS(T) plus serial number and county. Scoring for Essex amateurs is one point per contact multiplied by the number of counties worked. For non-Essex participants, one point for QSO multiplied by the number of Essex contacts. The following RSGB rules apply:—4b, 5a, 6a, 9a, 10a, 13-16, 18, 19, 20a,b,d and 21. Entries to G8IZN at 80 Lyndhurst Gardens, Barking, Essex, IG11 9XZ.

The 144/432 MHz contest runs from 1600-1600 GMT on March 3/4 and is a four section effort. *Viz;* 144 MHz single op., 144 MHz multi-op., 144/432 MHz single op. and 144/432 MHz multi-op. Single operators must observe a consecutive six hour break. Simultaneous operation of different stations in the 144/432 MHz multi-op. section is allowed. Usual radial ring scoring with a multiplier of 1 for 2m. and 5 for 70 cms.

The 1,296 MHz Open is scheduled for April 7, followed on the 8th by the 432 MHz Open & *s.w.l.* event.

Solar Activity

As the peak of this sunspot cycle approaches, the *solar flux* is averaging high values. This has produced reports of long distance propagation in the VHF bands. For example, U.K. Band 1 TV signals have been well received in Texas in mid-January. Charlie Newton, G2FKZ, told your scribe that some of his army of keen *s.w.l's* in Norfolk received good colour TV pictures on 62 MHz from Iceland at the end of January—"I Claudius" with sub-titles! Mike Allmark in Leeds reports Spanish TV on channels 3 and 4 around lunch time which G2FKZ suggests could be high F2 layer propagation. From the *DUBUS* 20m. VHF net, G4DEZ passes on the news that EA3ADW (Barcelona) received strong signals from Greek FM broadcast stations on 100 MHz between 1 and 3 p.m. on Jan. 26.

Mid-February would seem to be a prime time for cross-band 50/28 MHz trans-Atlantic contacts and the ZB2VHF beacon has already been copied in Texas. Reports would be welcomed from any reader who hears any 6m. signals from "across the pond."

Auroral Propagation

It seems that quite a few readers are confused by the various terms used in print and over GB2RS relating to propagation phenomena, such as *solar flux*, "*A*" *indices*, and the like. A pamphlet explaining these terms is now available from the Membership Services Officer at RSGB HQ on receipt of an *s.a.e.*

Charlie Newton reckons there are five main kinds of *aurora*. The first is a *visual only* one, frequently observed in Northern Ireland but which never produces any radio effects. The second is the *flare* caused type. Next there is the *coronal hole* event which he terms a "Scottish aurora" since it is usually a weak affair wherein only Scottish stations in the U.K. hear anything. The fourth type is the more spectacular *filament* event caused by the sudden breakdown of a long stream of solar particles shot out from the Sun's surface. The last type is the very weak *aurora* confined to extreme northerly latitudes associated with a high *solar flux* level even though the "*A*" *indices* are low. It is likely that, as more is learned from the thousands of observations made by radio amateurs, some of these five main types may reveal sub-divisions.

Mike Allmark listened in on the Jan. 7 *aurora* and lists 13 GM and GI stations and a couple of Dutchmen. Syd Harden, G2AXI (Hants.), did not pick up the event till 1915 GMT but no QSO's were made before fade-out at 2003. He called GM4DSZ on 2m. and GM4DIJ and GM3YOR on 4m. Eric Prince, G3KPU (Notts.), heard LA6HL (CS) calling HB9QQ on CW. He also heard many GM's and PA's, plus EI6AS, GI3RXV and SMØFUS.

Although Jon Dougherty, G4FUT (Tyne & Wear), missed the Jan. 7 fun, he had some nice QSO's on the 4th between 1644 and 1817 comprising:—LA6HL (CS09g); LA2PT (FT13b); LA3WU (CU47d); LA7KK (FU62j); SM4HJ (HT51c) and GM4DSZ (YR70e). QTF's were 40° for the Scandinavians. Also heard were DM2OF, UR2QB, UR2RIC (LS03g) and UR2RQT (MS80). The last signal heard was GM4DSZ at 1847 working a PAØ. The following day at 1731, Jon worked SM4EBI (GT41g). The *coronal hole* event on the 23rd produced nine contacts:—GM3XNE (XP26d); SM5CHK (HS36g); SM6CIX (FS06c); SM6HHN (GS52d); GM4BYF (YP04d); SM6ITE (GQ25c); SM4GVF (HT76a); LA8WF (FT02e) and GI3RXV (WO17f). The first QSO was at 1803 and GM4DSZ was the last station heard at 1923. But between 2153 and 2209, GB3LER was *auroral* at S1 although no other signals were heard.

Jon mentions the amount of *Ar* signals on 20m. during the first eight days of 1979, and suggests this phenomena is a useful indicator of possible 2m. *Ar* activity. Despite extensive listening he has not copied any *Ar* forward scatter since last October and wonders if this mode will reappear around the equinox? Regarding the Jan. 23 event, he mentions the deep QSB from 1840 onwards with a gradual decline in signal strengths. "It didn't go out with a bang, rather like a slow puncture!!"

In the Jan. 7 affair, Ian Harwood, G8LHT (S. Yorks.), worked GM8NXW (YP01g) at 1620 but signals were very weak by 1630. Things perked up again from 1800 and between 1815 and 1932 he contacted GM8BJF, GI8EWM (XO21j); GM4GUQ (XR40c); GM4HCO (XP09e); GM3RFA (XQ15j); GM8LKL near Edinburgh; GM4HKV (YP02h) and GM8MNG (YP36h?).

C. J. Read, G8MFP (Warks.), believes the Jan. 7 event was sparked off by a large *solar flare* recorded on his solar radio telescope on the 5th. He records 18 separate active spot areas on the visible disc that week. G8MFP reports it as a good *aurora* for him with several GM's worked. He notices two phases; 1552 - 1648 and 1850 - 2004. Another phenomenon he has noticed over the years is that when an *aurora* is in progress, GBNEE disappears altogether.

Steven Ruff, GI8EWM (Antrim), worked a few G's and GM's in the Jan. 7 event which produced six counties for his 1979 score. During the Jan. 23 affair, he worked GB2WR. This was our old friend Derrick Dance, GM4CXP, operating a special event station commemorating the 10th anniversary of the closure of the Waverley Railway route through the Borders. He gave the call, " . . . a real airing . . . " on the 7th on CW working DL, EI, G, GM, LA, ON, PA and SM3, 4, 7 and Ø, between switch-on at 1542 and 1915. In the Jan. 23 event, Derrick worked GM3YOR (Fife) and GM3WFJ (Central) on 4m. and G, GI, GM and OZ on 2m. All QTF's for both events were between 20 and 50°.

Four Metres

Not many in the way of reports this month. Dave Robinson, G4FRE (Warks.), has built a transverter driven by his *Yaesu* FT-200. He should be on reasonable power by now with a 4-ele. beam. The CW contest on Jan. 21 provided G2AXI and G3FIJ with a few counties for the 1979 table, but activity seems to have been only moderate. Derek Purchase, G3LXP (Herts.), only has indoor aerials and reckons conditions were down. He worked 31 stations.

Seventy Centimetres

Sheila Williams, G8KPL and husband Dave, G8JAG, are both QRV on 70 cms. from Cumbria with 7 squares worked so far. Graham Taylor, G8HVY (Dorset), mentioned to your scribe that he is building a new amplifier for the band. Ray Lucas, GW8GKF (Mid-Glam.), has eight of the popular 21-ele. *Tonna* has a CCTV camera up there too so aerials aloft for *E-M-E* work. Ray has a CCTV camera up there too so that he can be sure the array is well and truly lunar orientated. Peter Connors, G8LEF (W. Yorks.), mentioned a very good duct into FL square on the afternoon of Jan. 23, when he worked DK1PZ/P who was running just 10 watts. By contrast, the 2m. band seemed quite dead. G3AWZ passed on the news that David Butler, G4ASR, is now QRV from Hereford on this band and on 23 cms.

As it happened after our deadline, only "off air" reports have been received on the Fixed contest on Feb. 4. It seems that conditions may have been up a little to the north but continental activity was very low. Mike Pharaoh, G3LCH (S.W. London), had 41 QSO's, best DX being Huddersfield. Brian Harber, G8DKK (Beds.), thought this was one of the most active 70 cm. contests and he made 79 contacts. John Quarmby, G3XDY (Ipswich), lent all his gear to Graham Murchie, G4FSG, in Woodbridge and he had 45 QSO's including 8 PA's and an ON. Roger Taylor, G4BEL (Cambs.), had 124 QSO's so would seem to have scooped the pool.

G8MFP (Warks.) is now on the band using a *Microwave Modules* 144/432 MHz transverter and 40 watts amplifier to an 18-ele. *Parabeam*. The first week of the New Year brought four new squares for Geoff Brown, GJ8ORH in AF, CF, YH and ZF to bring his total tally to 30. He has a new transverter and 250 watts linear on 70 cms.

QTH LOCATOR SQUARES TABLE

Station	23 cm.	70 cm.	2 m.	Total
G3JXN	26	66	88	180
G3COJ	23	66	80	169
G8LEF	22	61	101	184
G8GML	11	63	106	180
GD2HDZ	11	34	67	112
G8EOP	8	36	38	82
G8IFT	7	18	49	74
G4DKX	5	30	68	103
G3SPJ	5	21	63	89
G3OHC	4	33	101	138
G8LHT	3	33	78	124
G3BW	3	25	91	119
G4AEZ	3	28	61	92
G2AXI	2	52	91	145
G8BKR	1	30	108	139
G4ERX	1	29	67	97
GJ8AAZ	1	24	67	92
G3POI	—	—	262	262
I4EAT	—	25	217	242
G8HVY	—	71	118	189
G3SEK	—	—	179	179
G3IMV	—	—	172	172
G4CMV	—	30	140	170
G3CHN	—	—	166	166
GM4CXP	—	25	131	156
G3FPK	—	—	154	154
G4DEZ	—	—	150	150
G4BWG	—	29	118	147
9H1CD	—	13	127	140
9H1BT	—	—	138	138
G3XCS	—	21	111	132
G8HHI	—	30	101	131
GJ8ORH	—	30	97	127
G4BAH	—	32	92	124
G8IWA	—	40	83	123
G8ATK	—	29	88	117
GM4COK	—	9	106	115
G4FCD	—	22	89	111
GJ8KNV	—	26	82	108
G3KPU	—	20	84	104
GM8NCM	—	12	84	96
G4FBK	—	5	90	95
G4AWU	—	—	94	94
G8KSS	—	—	93	93
G3FIJ	—	27	65	92
G8GII	—	22	63	85
G8KGF	—	5	80	85
G6UW	—	—	85	85
G4GEE	—	27	56	83
9H1C	—	—	83	83
G8KPL	—	7	74	81
G8JAG	—	7	73	80
G8JHX	—	—	80	80
GI8EWM	—	18	61	79
G8JJR	—	—	79	79
G8LGL	—	1	74	75
G8KSP	—	2	72	74
G8ITS	—	16	56	72
G4GET	—	—	70	70
GD3YEO	—	8	59	67
G8KUC	—	7	60	67
G8KLN	—	1	62	63
G4CIK	—	—	62	62
G4GLQ	—	—	61	61
G8JEF	—	—	58	58
G8MFJ	—	9	48	57
GW4FJK	—	—	57	57
OZ9IY	—	—	53	53
G4GSA	—	1	48	49
G4GXT	—	—	43	43
G8JGK	—	—	41	41
G4EYL	—	—	41	41
G8JAH	—	1	35	36
G8JAJ	—	—	21	24
G8JKA	—	—	21	21
G8PRG	—	—	15	15

Starting Date January 1, 1975. No satellite or repeater QSO's. "Band of the Month" 23 cm.

Meteor Scatter

The MS mode continues to attract a steady stream of new recruits. In pre-arranged sked contacts on SSB, some operators are now using half-minute periods to speed things up. There is no excuse for timing errors of more than two seconds now, so this seems to be a sensible development.

Listening on SSB during the *Quadrantids*, Mike Allmark (Leeds) logged F1JG (CD); OH5NW (NU); OH1FA (LU); F6DGY (BC); DC7HM (GM); DF3RU (FJ); I1DMP (EF); IW3QBC (GC); I2VRN (FF); DM3CN (GK); DM2BYE (HM); SM3FGL (IV); OE3UP (HI) and the HB9HB beacon in DH! Mike's countries score for 1979 is already 16 heard but his all-time total is 33 of which 28 are confirmed.

Geoff Brown, GJ8ORH, added six more squares in the *Quadrantids* on Jan. 3 thanks to SMØFFS (JT); LA3WU (CU); LA2PT (FT); OK1OA (HK); OE3UP (HI) and DK5FA (FK). Geoff lists further successes in December in the *Geminids* with DM4PSN (GK) and UR2RQT (MS) at 2,070 kms. He now runs a pair of 4CX250B's, as per a *Magazine* design of a few years ago, with a 16-ele. aerial and *Lunar* pre-amplifier.

John Hunter, G3IMV (Bucks.), is beavering away on MS and enters our Squares Table with a daunting 172 on 2m. He runs a single 4CX250B amplifier and a 10-ele. *Parabeam*.

Final Miscellany

Stephen Prior, G8KQB, seeks publicity for talks by Chris Bartram, G4DGU and Ian White, G3SEK, on VHF and UHF matters at 3.00 p.m. on March 18 at Cornwall House, University of Exeter. Talk-in on S22 FM by G3XEU and on 144·25 MHz SSB. Further details from Stephen at "Lafrowda Flats," Cornwall House, St. German's Road, Exeter.

Deadlines

That's it for March. CU at the "Winning Post." All your letters for the April issue by March 8 and for the May edition by April 5. Everything to:—"VHF Bands," SHORT WAVE MAGAZINE, 34, High Street, WELWYN, Herts., AL6 9EQ. *73 de G3FPK.*

TOROIDS IN HF APPLICATION PART I

N. H. SEDGWICK, G8WV

THERE is an increasing tendency for amateurs to use RF inductors and transformers wound on toroidal cores. This is not just part of solid-state techniques, although the low impedances encountered in solid-state RF amplifiers make possible RF coupling by wide-band untuned transformers, since iron dust and ferrite cored transformers have long been in use for connecting transmissions lines to aerials, or for matching an internal coaxial cable to an external open-wire line—performing the dual functions of impedance transformation and "unbalance to balance" connection. Such transformer cores are not necessarily "toroidal," but they all have closed magnetic circuits and require unity flux linkage between all the turns; ratings up to at least 30 kW are available, and they are surprisingly small.

In wide-band untuned application, the self-capacity of the winding limits the use of the transformers to quite low impedance circuits (typically not more than 600 ohms) to keep the circuit impedance significantly lower than the capacitive reactance in the transformer over the working frequency range. This is a normal requirement for any untuned device in HF service, and toroids can be used to core inductors in high impedance circuits which are tuned with the self-capacity becoming part of the tuning capacity in the normal way. Design of transformers requires that the inductive reactance of the winding is high compared with circuit impedance at the low frequency end of the working range, and capacitive reactance is high compared with circuit impedance at the high frequency end. Design compromises are determined by these two opposing factors, and in practice a range from 1 to 30 MHz is quite practicable. Indeed, the amateur requirement is seldom for one transformer to cover all HF bands, for it is unlikely for one aerial to present a constant impedance termination on all bands, and the maximum requirement seems likely to be matching a feeder to a three-band trap aerial.

Core Materials

One tends to lump coil cores into one category, but there is a big difference between "iron dust" and "ferrite" materials. Iron dust is, as the name describes it, the dust particles being electrically insulated from each other to make resistivity to eddy currents very high, while permeability is of the low order of ten or so; ferrites are non-metallic materials with magnetic properties. Mullard *Ferroxcube* cores come in a number of materials suited to a variety of frequency ranges and purposes; B2 material, with effective permeability of 200, is commonly used for HF power transformers. Toroids, E-cores, transformer cores, suppressor beads, rods and tubes made by Mullard are all listed under numbers prefixed with the letters'FX', and nothing of their characteristics, shape, or purpose can be gleaned from this number on its own.

TMP Electronics offer a range of American toroid cores in Q1 material with permeability of 125, and the ARRL *Handbook* makes reference to Q2 material as having permeability of 40 and being suitable for HF balun service. *Modular Electronics* advertise FX 2049 "two-aperture transformer cores", which are in B2 material and make excellent little transformers for such purposes as matching devices to coaxial cables, but the power rating is probably only a few watts. Mullard toroid cores in B2 material are:

FX 1595/3012,	12·7mm.	outside diameter.
FX 1231/3019,	25·4mm.	" "
FX 1588/3026,	38·1mm.	" "
FX 1108	89mm.	" "

The FX 200 plus types are nylon coated, but otherwise have the same characteristics as the first number given.

TMP Electronics also supply American 'Amidon' iron dust toroid cores in a number of mixes; those of interest to the HF user are the 2 and 6 mixes. The 2-mix is suited for 3·5 to 30 MHz working, and the 6-mix reaches from 10 MHz up into the VHF spectrum (for recognition the 2-mix cores are coloured red, and the 6-mix are coloured yellow). Two-mix permeability is 10, and that of 6-mix is 8·5; the core types are prefixed by letter 'T' and suffixed by the mix number, and the differentiating number between prefix and suffix appears to be the outside diameter of the core expressed in hundredths of inches. Thus, "T-68-2" is a toroid core of outside diameter 0·68 inches in 2-mix material.

Advantages of Toroids

1. Because they have a closed magnetic circuit, there should be no external lines of magnetic flux from them, and similarly they should not couple magnetically to adjacent inductive devices; hence they should need no screening.

2. Since every flux line cuts every turn the number of turns required for a given inductance may be directly calculated from the number of turns known to give, say, one microhenry, and also the transformation of impedance between windings is equal to the square of the turns ratio (as in audio transformers).

3. Very high Q's may be realised. 'Q' is equal to $\frac{2\pi fL}{R_s}$, where R_s is the lumped sum of all the loss resistances and is generally dominated by the copper loss, worsened as frequency increases by the RF skin effect which causes the current to concentrate towards the surface of the wire and so decreases the conducting cross-sectional area. The use of the core much reduces the number of turns required for a given inductance and this reduces copper loss; the core introduces iron or core loss and it is important to use the right core material for the frequency in use. When selecting the inductance and capacity values for a resonant circuit, one tends to make L high in the LC ratio because the formula for Q shows that Q increases directly with L. Unfortunately so does the copper loss, and in air-cored coils Q tends to level out in practice over the HF spectrum as a result. When a closed magnetic core is used for the inductor of a resonant circuit one can play core loss against copper loss, and also LC ratio against copper loss to find an optimum Q which can run quite high.

5. Toroid windings are physically and electrically very stable; small ones can be hung in the wiring without other support, in view of their independence of external influences.

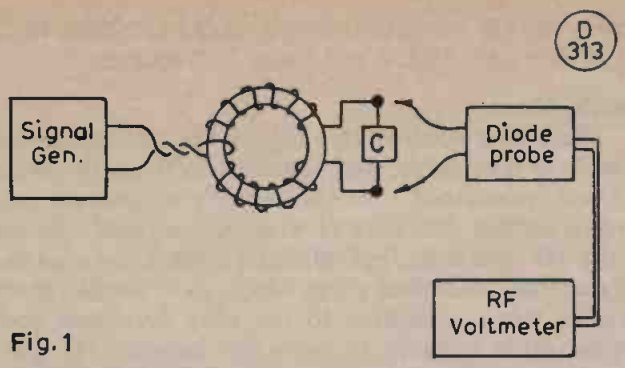


Fig. 1

Simple test set-up to investigate an unknown toroidal core; C is a silver-mica capacitor of any known value from 100 to 330 pF, and preferably not worse than 2 per cent tolerance.

6. They are very easy to wind: turns are few and every turn is supported by the core, and the wire is always thick enough to be easily handled.

7. They are particularly suited to balanced circuit windings with centre taps.

Calculation of Inductance

There are plenty of toroid cores advertised for sale under the "no gen" ticket: the writer's experience is that these things are generally useless for HF practice. Mullard *Ferroxcube* devices are sometimes advertised under their FX number, which is fine if the reader happens to have some way of discovering what those numbers mean; most commonly the FX numbers one seem to refer to suppressor beads. It is therefore of interest to study how the "no gen" toroidal core may be investigated within the limitations of the shack.

Test equipment required is a calibrated signal generator covering the HF spectrum, and an RF voltmeter, fitted with a low capacity diode probe. The multi-purpose test instrument described by the author in the March 1978 issue of *Short Wave Magazine* will serve as both these items. A simple pocket calculator to speed up the arithmetic is a great boon, and it helps if it has a square root facility, *see* Fig. 1.

The first step is to put a sample winding on the core, and if one is aiming at the HF performance, fifteen turns will be very typical, so put on that number, spaced to occupy the complete winding length, and secure the ends by tying with thread to the core. Connect the signal generator (SSG) to a single turn of hook-up wire wound on the core, and solder a close tolerance silver mica capacitor of anything from 100 to 330 pF across the main winding. Since we have "no gen" on the core the actual capacity used to resonate the circuit does not matter much so long as it falls within the range of value one expects to find in HF tuned circuits. We must, however, know the capacity value accurately because that and the number of turns are the only factors we can be sure of at the start.

Now connect the RF voltmeter probe across the LC circuit formed by the toroid and capacitor and tune the signal generator with its output turned fully up across the frequency ranges until a voltage peak is read on the voltmeter, indicating resonance. The rise and fall of the voltage as the signal generator passes through the resonant frequency traces the selectivity curve of the tuned circuit, which is determined by the Q. If the core is going to be useful for tuned circuits at that sort of frequency, one expects the voltage to rise and fall quite sharply, indicating a reasonably high Q. A flat, rather indeterminate peak spread over a big frequency range is a sure sign of low Q, in which case the check may be repeated with more turns and more capacity to see if the performance improves at lower frequency. It is worth playing around a little with LC ratio and frequency, but if there is no luck in the HF region the toroid is probably meant for some other purpose and is best dismissed with a shrug.

If all goes well and the resonance is clearly and sharply defined we can carry on. Note the resonant frequency from the signal generator dial and fit this and the known capacitor value into the usual formula:

$$L = \frac{25330}{f_o^2 C} \quad \ldots\ldots (i)$$

where f_o is in megahertz, C in picrofarads, and L in microhenries.

The next step is to relate L with the number of turns, *n*. Inductance varies as the square of the number of turns, and we can derive a constant, *k* for the core from the information we now have which can be used in simple formulae to design or check any inductance wound on that type of core. We find *k* for that core once and for all by substituting numerical values of the inductance, L, in microhenries and turns *n* in the formula:

$$k = \frac{L \times 10^3}{n^2} \quad \ldots\ldots (ii)$$

Thereafter, design formulae for using that type of core are:

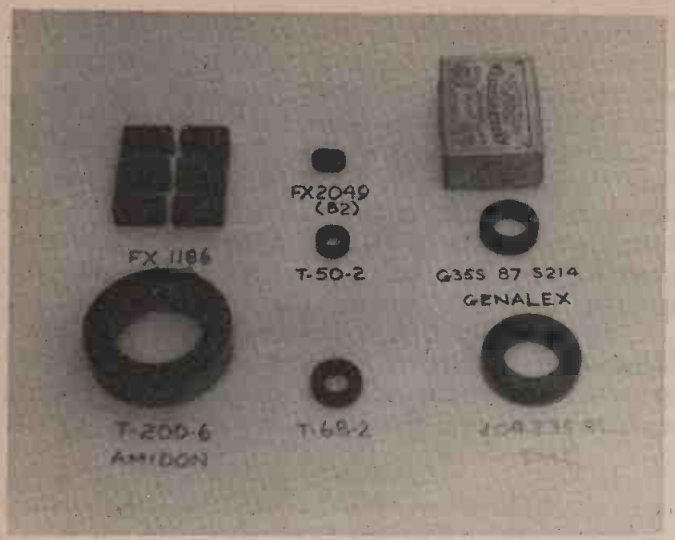
$$L = n^2 k \times 10^{-3} \quad \ldots\ldots (iii)$$

and:

$$n = \sqrt{\frac{L \times 10^3}{k}} \quad \ldots\ldots (iv)$$

Q Measurement

At this stage we should consider quantifying the Q so that we can observe trends towards or away from optimum LC ratios and frequency ranges; there seem to be many ways in which Q of a tuned circuit can be measured. One common way is to introduce a very low non-reactive resistor (something like 0·05 ohms!) in series with L and C and to connect a variable frequency signal source across it. The circuit magnification Q is then determined by measuring or calculating the voltage across the resistor at resonance and measuring with an RF voltmeter the voltage across either the coil or the capacitor: the ratio of the latter to the former voltages is the Q figure. In common with all other methods, the Q figure so obtained is that of the LC circuit and not just of the inductor, but provided the capacitor used is a good quality one for RF service it is fair to assume that the losses affecting Q are predominantly from the inductor, so that the small contribution from capacitor and wiring may safely be ignored. However, the voltage magnification method of measurement requires a hefty signal source to develop a measurable voltage across the low resistor, or alterna-



A selection of ferrite and iron dust cores which have been available from retail stockists during the last year or so. T-200-6, T-68-2 and T-50-2 are iron dust types with k of 10, 5.7 and 5 respectively. FX-2049 is a 'transformer core' by Mullard and has a measured k of 205; the Genalex core has a k of 90 and works well as an HF power transformer, not getting unduly hot at 30 watts rating; the Q in a low-level tuned circuit is mediocre. The TMC core behaves like an iron dust core with a k measured at 13, and high Q when used in a tuned circuit at low-level; used in an HF power transformer, it seems happy handling 80 watts CW. The FX-1186 has been included to show what a Ferroxcube E-core looks like. Two identical cores may be stuck or taped together to increase power rating.

tively an accurate RF milliameter to measure current into it, and these facilities are uncommon in the shack. The writer prefers to deduce Q of a tuned circuit from its selectivity gradient, which can be done with the test equipment set-up already mentioned.

Connect up the inductor under test with a close-tolerance silver mica capacitor across it of a value to resonate the circuit at the required frequency; call this capacitor C_o and adjust the signal generator to the resonant frequency of the LC circuit. Measure the voltage E_o across the LC circuit. Now connect another close-tolerance capacitor of RF quality, having a capacity around one-tenth of that of C_o, across C_o. This will detune the LC circuit from peak resonance and the voltage E across it should be noted. The Q value of the LC circuit may then be calculated by the formula:

$$Q = \frac{C_o}{C}\sqrt{\left(\frac{E_o}{E}\right)^2 - 1} \quad \ldots\ldots\ldots\ldots (v)$$

Note that the method relies entirely on the capacity and voltage ratios and is extremely simple. The main inaccuracy which may arise is in the tolerances of the capacitors: if one is going to do a lot of such measurements, it is worth calibrating an air dielectric tuning capacitor, and varying it either above or below the C_o setting to obtain the off-tune setting in the formula. Note that C is really the change in capacity between the resonant and off-tune positions, and would be described as $\triangle C$ in the formula if one variable capacitor were used to provide both capacity settings in the test set-up.

We are left with the frequency range of the core to be investigated, and this can be done by making Q measurements with a variety of LC combinations across the HF spectrum, noting where Q begins to fall-off as one goes higher and lower in frequency.

Ferrite Cores

These have considerably higher effective permeability than iron dust cores, and require less turns to produce a given inductance. In the writer's experience ferrite toroids exhibit mediocre Q when wound and resonated in the HF spectrum, but Mullard cores known to be of B2 material, and other cores which show similar characteristics when submitted to the tests described above, appear quite suitable as cores for untuned HF power transformers. In particular, the little FX 2049 two-aperture core is classified as a "transformer core" and does the job admirably, yet seems quite unsuitable for tuned circuits.

One finds little that is helpful to the amateur in the various handbooks he normally consults, concerning characteristics of core materials. Professional books can be contradictory and one needs to look at publication dates before deciding how much salt to take in one's pinch! (One learned book published in 1961 treats ferrites only as microwave components). The earliest mention of iron dust toroids the writer has found is in a professional handbook on aerials published in 1952, which mentions their use in baluns for receiving only, over a range of $8\frac{1}{2}$ octaves in the frequency spectrum.

Ferrites are listed under a confusing variety of type numbers, of which some American ones seem to have been taken from the list of international call sign prefixes! We learn that initial permeability of 3B9 is 1800 and 4C4 is 125, whilst Mullard quote effective permeability of B2 as 200 and D4 as 1150, and many others beside. It was mentioned earlier that Q1 material has an unqualified permeability rating of 125 (could this be 4C4?) and Q2 similarly rates 40 and is recommended for your home-brew 1 : 1 or 1 : 4 balun. It seems that the lower any kind of permeability is for ferrites, the higher they reach in the frequency spectrum; one American professional handbook actually mentions frequency in their characteristics, fitting material with initial permeability of 750 into the 200-2500 kHz range, and that with 125 into the 1-20 MHz range, so it looks a fair assumption that our Q2 with permeability of 40 will aspire happily to 30 MHz.

The Q of inductors cored with iron dust toroids came out at around 125 when measured by the method detailed, but when ferrite cores were tried the Q came out around 25; this was unexpected as the lower Q figure could only be related to core loss and the writer had always thought ferrite would show up better than iron dust. Certainly the *Ferroxcube* pot cores in the old LA 1 to 7 series, used

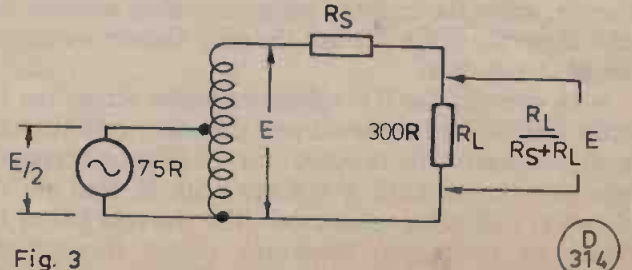


Fig. 3 D 314

A 2 : 1 turns ratio transformer matching 75 to 300 ohms, illustrating core and copper losses lumped into hypothetical resistors Rs in series with load. *See* text.

between 10 and 100 kHz, produced Q's from 350 to 500 and it was a bit difficult to readjust expectations to 25 even when frequency and application were very different. An attempt was made by simple mathematics to see how bad the loss under such circumstances would be.

Consider Figure 3; this shows a typical 75 ohm unbalanced to 300 ohms balanced RF power transformer. Suppose the inductance L of the total winding is 20 microhenries and the Q measured at 10 MHz is 125.

Now $Q = \frac{2\pi fL}{R_S}$ where R_S is the lumped sum of all losses and is represented by a series resistor in the diagram; for a Q of 125, R_S must equal 10 ohms. When loaded with 300 ohms the voltage across the load will be $\frac{R_1}{R_1 + R_S}$ E, which equals $\frac{300}{310}$ E, making the transformer loss 0·3 dB.

If the unloaded Q is reduced by a factor of 5 to 25, R_S will become about 50 ohms, and when loaded the voltage across the load will be $\frac{300}{350}$ E, increasing the transformer loss to about 1·3 dB. For receiving application only such a loss would be no worry at all, and at low power transmitting it is not serious, but it does represent loss of around one-quarter of the power handled, and the wasted power would be dissipated in heating the transformer, which brings up to another point.

Due to thermal agitation of electrons, a temperature is reached when magnetic materials lose their magnetic properties, and this is called the Curie point. In the case of iron it is 770° C and so is not a problem to the amateur, but ferrites are much lower, ranging from 100° to 300°C, with one listed as low as 85°C. A ferrite-cored power transformer used as a balun stuck at the top of a mast in brilliant sunshine on a hot summer's day could be at 38°C before any power is turned onto it. A poor SWR will, of course, increase the loss in the transformer.

The idea of calculating the power loss from the data available as above is rather wistful, for it assumes that R_S will be the same when the Q is measured at low level and when the transformer is being run at full power; this is where the qualifications of the quoted permeability are so confusing. Permeability is the ratio $\frac{B}{H} = \frac{\text{Flux Density}}{\text{Magnetising Force}}$. What is meant in the core data when the term "initial permeability" is used? Langford-Smith defines it as the "permeability at values of H approaching zero", so it probably holds good for low-level tuned circuit work, but all the well-thumbed reference books in this shack make the point that permeability increases with H up to saturation point, albeit dealing with power and audio frequency cores, so the inductance should change with H! It gets even worse if there is a DC component in the current, for that introduces "incremental permeability". However, permeability curves vary much with materials and one would hope that the "effective permeability" figures given stay reasonably constant over a fair power range in practice when dealing with ferrites.

to be continued

CLUBS ROUNDUP

BY *'Club Secretary'*

THIS is the first of the new format "Clubs" feature; as such we would ask every reader who is a member of a local club to look at the list. If his club is there, to make sure the details are right: and if it isn't, to get the Hon. Sec. to write in with the details.

We certainly won't complain if we continue to get monthly updates and newsletters, but with this method we can take one letter to cover several months, so easing the drain on the club treasury in postage and time. On the other hand, for it to be successful, we *must* be advised of any relevant changes.

Apart from trying to save the club funds, the new format will save space which can be turned to other and more directly interesting articles.

Acton, Brentford & Chiswick, have the third Tuesday every month at Chiswick Trades & Social Club, 66 High Road, Chiswick.

Addiscombe can be found on Tuesday evenings from 9.15 onwards at the Spreadeagle, Portland Road, South Norwood.

A.R.M.S. This is the one for the mobile operator, be he licensed or SWL. Details, G3FPK, *see* Panel.

Ashford (Kent) live at the top of Hart Hill, near Charing, where they foregather on Tuesdays.

B.A.R.T.G. If you listen on the air or transmit by RTTY, this is the one for you. Details from GW3IGG—*see* Panel.

B.A.T.C. caters for the Amateur Television chaps, whether slow-scan, fast-scan, b/w or colour. For the Hon. Sec., *see* Panel.

Bishops Stortford have a room at the British Legion club, Windhill, Bishops Stortford. Don't confuse them with Radio Stortford in the same building on the same evening!

British Rail covers all the various branches of B.R. For details, contact the Hon. Sec.—*see* Panel.

Bury are based at Mosses Community Centre, Cecil Street, on the second Tuesday in each month.

Cheltenham. The combined group foregather at the Old Bakery, Chester Walk, behind the Public Library, on the first Thursday and third Friday.

Cheshunt book the Church Room, Church Lane, Wormley, Herts. every Wednesday.

Chichester have a long address! Room 34A, Lancastrian Wing, Chichester High School for Boys, Basin Road, Chichester. First Tuesday and third Thursday.

Chiltern now get together in the canteen, John Hawkins Ltd., Victoria Street, off (A40), Oxford Road, on the last Wednesday each month.

Chippenham. Tuesdays, 7.30 to 10.00, at the Liberal Club, Chippenham.

Cornish show every other club how to thrive and be independent. Look in on the first Thursday of each month, at the SWEB Clubroom, Pool, Camborne.

Crawley next, at the United Reformed Church Hall, Ifield, second and fourth Wednesday. Check with Hon. Sec. at the address in the Panel, as some meetings are in members' homes.

Cray Valley. Christchurch Centre, High Street, Eltham, on the first and third Thursdays. First one formal, the other one a natter.

Dartford Heath D/F. The one for those who are keen on direction finding and transmitter hunts. First and third Fridays at the Scout Hut, Broomhill Road, Dartford. (Check with the Hon. Sec. first in summer!)

Derby. Every Wednesday evening on the Top Floor at 119 Green Lane, Derby.

Exeter. We believe the Hq. is at Priory School but could do with confirmation. Contact, Mrs. M. Jefford, on 03954-3735.

G-QRP Club. For the low-power merchants, and the best two-quids-worth in UK amateur radio today. Contact the Hon. Sec.—*see* Panel.

Hereford use the Civil Defence Headquarters, Gaol Street on the first and third Fridays, plus some outings.

I.R.T.S. Region 1. If you want to know about anything going on in EI, talk to the Hon. Sec., and he'll point you out the right way. Hq. address is 91 Lower Baggot Street, Dublin. *See* the Panel for the Hon. Sec's. address.

Melton Mowbray. Here it's the third Friday each month at St. John Ambulance Hall, Asfordby Hill, Melton Mowbray.

Northern Heights have an odd address: British Sub-Aqua Club, Mountain, Queensbury. They are there every Tuesday.

Deadlines for "Clubs" for the next three months—
(*April issue—February 23rd*)
May issue—March 30th
June issue—April 27th
July issue—May 25th
Please be sure to note these dates!

Ormskirk go to each other's homes each Wednesday; so for courtesy, contact the Hon. Sec. first—*see* Panel.

Peterborough occupy the Scout Hut in Occupation Road, on the third Friday each month.

R.A.I.B.C. Everyone connected with amateur radio must know this is the one for the blind and disabled, both SWL and licensed. These are the full members; but to make the club *work* there must be *supporters* and *representatives*. A grand crowd to know.

Reigate now use the Constitutional Centre, Warwick Road, Redhill; try the third Tuesday evening in the month.

Saltash haven't talked to us about their doings for some while, but we believe they are still booked every other week at Burraton Toc H. For more recent data, try G3XCS, or the Hon. Sec.—*see* Panel.

Names and Addresses of Club Secretaries reporting in this issue:

ACTON, BRENTFORD & CHISWICK: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, Acton, London W4 8LB. (*01-992 3778.*)
ADDISCOMBE: P. J. Hart, G3SJX, 42 Gravel Hill, Croydon, Surrey CR0 5BD. (*01-656 9054.*)
A.R.M.S.: N. A. S. Fitch, G3FPK, 40 Eskdale Gardens, Purley, Surrey CR2 1EZ.
ASHFORD (Kent): J. A. Clarke, G3TIS, Yeomans Cottage, The Street, Brook, Ashford, Kent. (*Wye 812888.*)
B.A.R.T.G.: J. P. G. Jones, GW3IGG, Heywood, 40 Lower Quay Road, Hook, Haverfordwest, Dyfed SA62 4LR.
B.A.T.C.: M. Cox, G8HUA, 13 Dane Close, Broughton, Brigg, South Humberside.
BISHOPS STORTFORD: T. E. White, G8LXB, 79 Elmbridge, Old Harlow, Essex.
BRITISH RAIL: R. V. New, 29 Little Dock Lane, Plmyouth, Devon PL5 2LZ.
BURY: E. R. Thirkell, G4FQE, 59 Oulder Hill Drive, Bamford, Rochdale. (*Rochdale 32730.*)
CHELTENHAM: G. Cratchley, G8MZV, 47 Golden Miller Road, Prestbury, Cheltenham. (*Cheltenham 43891.*)
CHESHUNT: R. E. Chastell, G8LNM, 4 Fairley Way, Cheshunt, Herts. EN7 6LG. (*Waltham Cross 35393.*)
CHICHESTER: T. M. Allen, G4ETU, 2 Hillside, West Stoke, Chichester PO18 9BL. (*West Ashling 463.*)
CHILTERN: N. C. Ambridge, G4FRL, 53 The Avenue, Chinnor, Oxon. OX9 4PE.
CHIPPENHAM: P. J. Tuck, 178 St. Edith's Marsh, Bromham, Chippenham, Wilts SN15 2DJ.
CORNISH: S. T. S. Evans, G3VGO, "Glengormley," Carnon Downs, Truro, Cornwall. (*Devoran 864255.*)
CRAWLEY: A. V. H. Davis, G3MGL, 41 Gainsborough Road, Crawley, West Sussex RH10 5LD. (Crawley *20986.*)
CRAY VALLEY: P. J. Clark, G4FUG, 42 Shooters Hill Road, London SE3. (*01-858 3703.*)
DARTFORD HEATH D/F: A. R. Burchmore, G4BWV, 49 School Lane, Horton Kirby, Dartford, Kent DA4 9DQ.
DERBY: Mrs. J. Shardlow, G4EYM, 19 Portreath Drive, Darley Abbey, Derby DE3 2BJ. (*0332 56875.*)
EXETER: Mrs. M. Jefford, 29 Dukes Road, Budleigh Salterton, Devon EX9 6QL. (*03954 3735.*)
G-QRP Club: Rev. G. C. Dobbs, G3RJV, "Willowdene," Central Avenue, Stapleford, Nottingham. (*Sandiacre 394790.*)
HEREFORD: S. Jesson, G4CNY, 181 Kings Acre Road, Hereford. (*Hereford 3237.*)
I.R.T.S. (Region 1): J. Ryan, EI6DG, 23 Dollymount Grove, Clontarf, Dublin, 3.
MELTON MOWBRAY: R. Winters, G3NVK, 32 Redwood Avenue, Melton Mowbray, Leics. LE13 1TZ. (*Melton Mowbray 3369.*)
NORTHERN HEIGHTS: L. Cobb, G3UI, 27 Moorlands Crescent, Cousin Lane, Halifax, West Yorks. (*Halifax 60574.*)
ORMSKIRK: P. J. Kay, G4GCB, 24 Laurel Avenue, Burscough, Ormskirk, Lancs. (*Burscough 892416.*)
PETERBOROUGH: L. Critchley, G3EEL, 36 Waterloo Road, Peterborough, Cambs.
R.A.I.B.C.: Mrs. F. Woolley, G3LWY, 9 Rannoch Court, Adelaide Road, Surbiton KT6 4TE.
REIGATE: F. H. Mundy, G3XSZ, Westview, rear of Manor Farm, off Reigate Road, Hookwood, Surrey. (*Horley 73878.*)
SALTASH: J. K. Reynolds, G8LLR, 47 Lulworth Drive, Roborough, Plymouth. (*Plymouth 771135.*)
SILVERTHORN: C. J. Hoare, G4AJA, 41 Lynton Road, South Chingford, London E4 9EA. (*01-529 2282.*)
SOLIHULL: R. A. Hancock, G4BBT, 80 Ulleries Road, Solihull, West Midlands B92 8EE.
SOUTHDOWN: B. Chuter, G8CVV, 15 Coopers Hill, Willingdon, Eastbourne, East Sussex BN20 9JG.
SOUTHGATE: J. Fitch, G8EWG, 16 Kent Drive, Cockfosters, EN4 0AP. (*01-440 7353.*)
STEVENAGE: T. J. Tugwell, G8KMV, 11 The Dell, Stevenage, Herts. SG1 1PH.
STOURBRIDGE: S. Shacklock, G4IP, 12 St. Peters Road, Stourbridge, West Midlands DY9 0TY.
SURREY: R. Howells, G4FFY, 7 Betchworth Close, Sutton, Surrey SM1 4NR. (*01-642 9871.*)
SUTTON & CHEAM: J. Korndorffer, G2DMR, 19 Park Road, Banstead, Surrey. (*01-255 8729.*)
SWANSEA: P. Jones, GW4GRI, 27 Gorwydd Road, Gowerton, West Glam. (*Swansea 873986.*)
THAMES VALLEY: R. J. Blasdell, G3ZNW, 92 Bridge Road, Chessington, Surrey, KT9 2ET.
VERULAM: B. Pickford, G4DUS, "Netherwood," 130 The Drive, Rickmansworth, Herts. (*Rickmansworth 77616.*)
W.A.C.R.A.L.: L. Colley, G3AGX, Micasa, 13 Ferry Road, Wawne, Nr. Hull, Yorks. HU7 5XU.
BOURNEMOUTH (Wessex): G. D. Cole, G4EMN, 3A Cavendish Road, Bournemouth BH1 1QX. (*Bournemouth (0202) 20027.*)
WEST KENT: B. P. Castle, G4DYF, 6 Pinewood Avenue, Sevenoaks, Kent TN14 5AF. (*Sevenoaks (0732) 56708.*)
WOLVERHAMPTON: J. Cook, G8EDG, 75 Windmill Lane, Castlecroft, Wolverhampton WV3 8HN.
WORCESTER: M. Tittensor, G4EKG, 16 Durcott Road, Everham, Worcs. WR11 6EQ. (*Evesham (0386) 41105.*)
YEOVIL: D. L. McLean, G3NOF, 9 Cedar Grove, Yeovil, Somerset.
YORK: K. R. Cass, G3WVO, 4 Heworth Village, York.

Silverthorn live in a 'stately home,' so shine your shoes! Fridays at Friday Hill House, Simmons Lane, Chingford E4 6JH, which is also the address for the Hon. Sec. unless it's urgent.

Solihull take over the Manor House in High Street, on the third Tuesday each month. We believe they also have an informal at a local pub each month. Ask the Hon. Sec.—*see* Panel.

Southdown now are based on the Chaseley Home, South Cliff, Eastbourne. Other details from the Hon. Sec. —*see* Panel. It's the first Monday in the month, or second should the first be a Bank Holiday.

Southgate will be found on the second Thursday of each month at the Scout Hut, Wilson Street, in Winchmore Hill—Winchmore Hill *Green* and you're in the wrong place.

There are two venues for the **Sutton & Cheam** get-togethers; the first is Rays Social Club, London Road, Cheam, and the other one Sutton College of Liberal Arts (SCOLA). It looks as though they have the third Friday evening and the last Wednesday of each month, the Wednesday sessions usually at 'Rays.'

Swansea are based on Sketty Park Sports & Social Club, Aneurin Way, Sketty Park, Swansea on alternate Tuesdays.

Now back to the London area, to **Thames Valley** and their booking at Giggs Hill Green Library, Thames Ditton, which is for the first Tuesday in every month.

At **Verulam** the main meeting is on the fourth Thursday in the Civil Defence Hall in Chequer Street car park. They also have an informal on the second Thursday, which in winter-time is at the R.A.F.A. Hq. in Victoria Street.

WAMRAC, as it used to be called, is now *WACRAL;* no longer for Methodists, now for all Christian radio amateurs and SWL's. Details are obtainable from the Hon. Sec., at the address in the Panel.

By the time this comes to be read, **Wessex** will have changed their name to Bournemouth; they are based on the Dolphin Hotel, Holdenhurst Road, on the first and third Fridays.

The area around Tunbridge Wells is catered for by **West Kent**, who are also booked for the first and third Fridays, the Hq. being the Adult Education Centre in Monson Road.

The weekly routine is practised at **Wolverhampton**, the base being Neachells Cottage, Stockwell End, Tettenhall, Wolverhampton, on Monday evenings.

Now to **Worcester** and here the place to look for is the Old Pheasant, in New Street, on the first Monday in each month.

Thursday evenings see the gathering of the **Yeovil** gang, at Hut 101, Houndstone Camp, Yeovil.

York have Hq. at the United Services Club, 61 Micklegate, York, where they can be found each Friday *except* the third one.

Wind-Up

So, there it is. Corrections, new information from other clubs, etc., should be addressed to "Club Secretary," SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ.

SLOW-SCAN TELEVISION PART I

IDEAS AND UNITS

J. BROWN, G3LPB

SLOW-SCAN TV (SS/TV) is nothing new, and we are not breaking any new ground in these three articles. Amateur radio is a hobby of many facets, and the chap we are after now is the fellow who has a mite of curiosity, enough to make him wonder what the "outer-space" noises on the SS/TV frequencies do, and how they are turned into pictures; and the easiest way to *understand* what goes on is to build up a circuit and then get the bugs out of it—much nicer than the computer-programmer who "debugs" his effort!

History

Back in 1958, Copthorne Macdonald was W4ZII—we'll stick with call because he has moved around since then—started the ball rolling with an article in *QST*. The first proposition was to use a sub-carrier and amplitude modulate it. Imagine a carrier with a single tone on it, with the amplitude of the tone varying with the information transmitted, and you've got it; the tone is the sub-carrier. Copthorne and his pals demonstrated that if the tone sub-carrier were to be kept steady in amplitude but was varied in *frequency* instead, the signal was less apt to be cut-up by the QRM that is a natural part of amateur radio activity, so the latter arrangement (often abbreviated to SCFM) became a standard by around 1960. Either method could be used, with AM or SSB transmitters, but the universal adoption of SSB for knockabout use on the bands has resulted in SS/TV being transmitted from SSB rigs and resolved by SSB receivers. Just as SSB signals are rarely received at the correct pitch and so sound unnatural, so with SS/TV—but the machine cannot deal with mis-tuning in its basic form, and we have to add a bit of gadgetry.

If one listens around the bands, one would think the mode is very expensive to judge by the commercial names bandied about: it needn't be so—if you go about it the home-brew way. BATC put out a booklet on the mode with circuits, by G3RHI, and it is still available in updated form from them. The first really British bit of commercial gear was the SSM-1 from *Spacemark Ltd.*, available either complete or as a full kit, or as a basic version consisting of a couple of PCB's and the more specialist parts; lots are still to be heard around the bands. The American equivalent was the *Venus*, and again they are still to be found. Both, as far as the writer knows are past history, but there is a small outfit making PCB's for SS/TV, of which more anon.

Standards

Since they were based on mains frequency, we have two parallel sets, for 50 Hz and 60 Hz respectively. The *aspect ratio* is 1 : 1—a *square* picture. The line timebase is a division by 4 from 60 Hz to give 15 lines/sec., while 50 Hz areas divide by three to give 16⅔ lines/sec. By the same token, the frame speed is mains-derived and comes in at 8 seconds per frame in U.S.A., and 7·2 secs/frame

in 50 Hz areas. Either way, we end up with a 120-line scan, the raster going left-to-right and top-to-bottom in its tour of the tube-face. Sync. pulses are needed, as in ordinary TV, to keep everything tracking; the line sync. pulse lasts for 5 milliseconds and the frame for 30ms. Listen to a SS/TV signal on your SSB receiver, and it will sound like a tone, wandering in frequency between limits. One limit will be saying to the receiver "I am your sync. pulse"—this one is 1200 Hz: and the other limit, which is 2300 Hz says "Peak white," All the tone range must lie between these two limits, bearing in mind as we say this that "black" is the colour of the TV screen and "white" is the brightest spot we can generate without de-focussing. We also have to recall that if 1200 Hz is to be sync., we must make "black" significantly different, so we make it 1500 Hz.

Now, if we assume we can turn those audio frequencies into a picture, it doesn't require a genius to see that the most important bit is the 1200 Hz, because if we haven't got it tuned in right on the receiver (or if we are sending it out wrong!) then our SS/TV unit won't recognise a sync. pulse when it sees it.

But—why does the varying frequency system work better, as already mentioned, than the varying amplitude method originally tried and discarded? The nub of it it is the self-same "fringe area" problem we see with domestic TV. Black is the colour of the tube face, and the best white will be the brightest spot we can obtain from the *signal* rather than the TV's potential to produce a brighter white, only to be achieved if there is enough signal at the aerial terminals. Consider now the SCFM or "wandering-frquency" arrangement: the content of the signal lies in the *frequency*, and so long as the receiver can recognise 2300 Hz just above the QRM and noise, it still says to the tube "Peak white, please."

Definitions

It seems as good a point here as anywhere to try and define some of the terms used or heard, so as to save confusion.

Grey Scale: the shades of brightness between what we call black and what we call white, as discussed in the previous paragraph.

Video: from the Latin "I see" and is universally used to describe the signal put into the transmitter and taken out of the receiver; the TV equivalent of what we call 'audio'.

Sync.: synchronisation is needed to "keep the picture in step" and the signals generated specifically for this purpose are called sync. signals.

Brilliance: as in oscilloscopes of b/w TV sets, this is the control that winds up the brightness of the screen in the absence of a picture.

Contrast: this determines the range from black to white; 'brilliance' and 'contrast' work together to give the best quality picture.

Focus: ideally the spot on the CRT should be infinitely small, and the degree to which the spot has area settles the size of the smallest detail that can be seen.

Shift: there may be shift controls for both vertical and horizontal; they are used to centre the picture on to the viewing area of the screen.

Line: the spot sweeps a line across the tube in a horizontal direction, flies back and then at the right moment starts again in the same way.

Frame or *Field:* the voltage which ensures that each line sweep is in its proper place, below its predecessor, and above the one following. In other words pertaining to vertical movement of the raster.

EHT: Extra High Voltage—just as in the TV set, the voltage that goes to the tube's final anode. Treat with care.

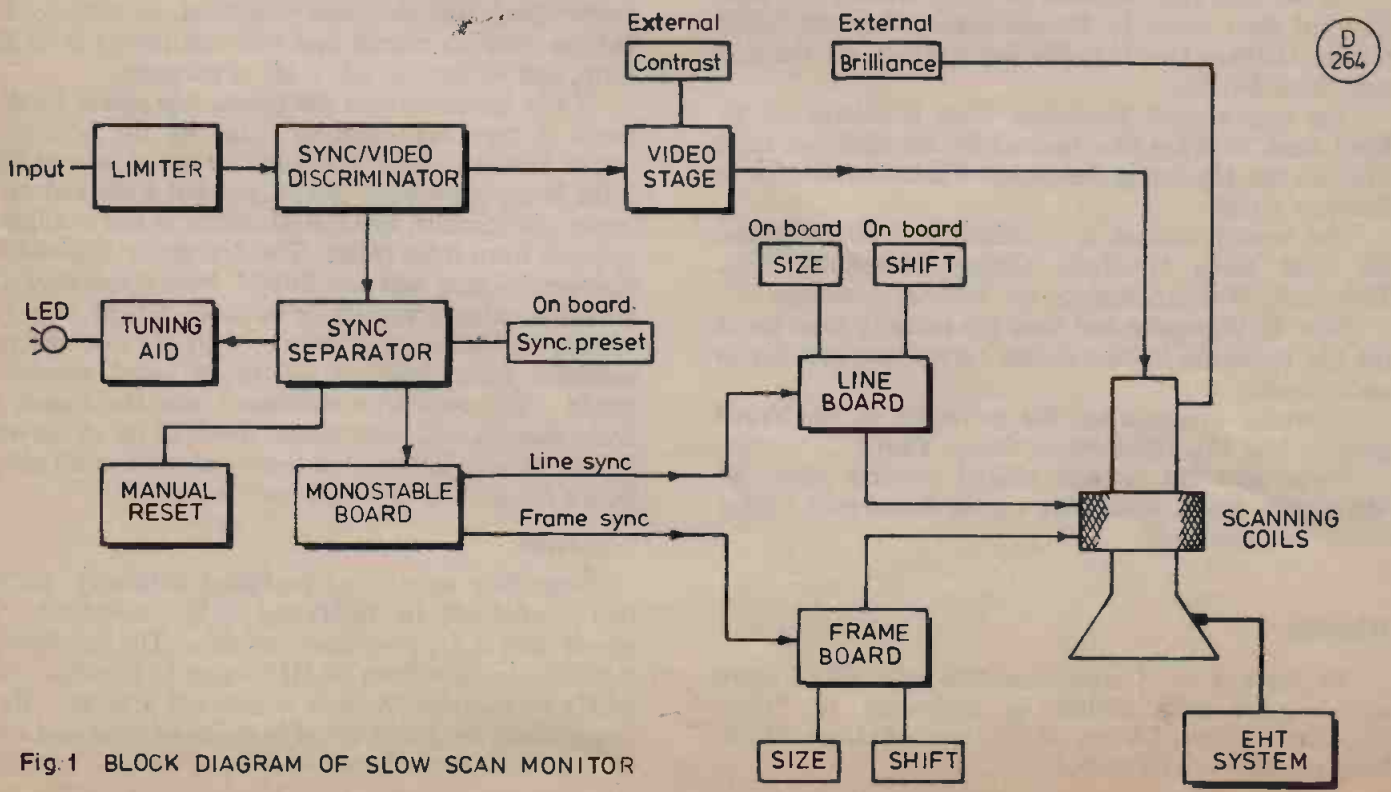


Fig. 1 BLOCK DIAGRAM OF SLOW SCAN MONITOR

Main unit plus the PCB's.

Scan Conversion: can mean many things depending on the context, but in essence means taking fast-scan information or picture and turning it into slow-scan signal, or *vice versa*. The use of these is to take the slow-scan picture and display it on an ordinary type TV display, so that one does not suffer from the gradual decay of the picture as the scan gets further on from the point being looked at. Home-brewed, difficult, commercial expensive!

VCO: Voltage Controlled Oscillator. Ours is an audio one and is switched from one frequency to another as we go from sync. to black to white. The result is the audio noise coming out of a receiver correctly tuned to a SS/TV signal, or the audio noise fed into the transmitter. It is always fed through a low-pass filter, which removes any unwanted harmonics or QRM.

This last feature is rather useful, insofar as it means that if one is in trouble, another amateur can send a tape of a good signal, and if his machine is twin-track, he can put comments on the other track. It also enables a standard tape to be transmitted if one has only a built receiver as yet.

Monitors

Here we come to the nitty-gritty. *M.K. Products* do a set of PCB's for a monitor and this is the show that will be discussed; however, at the end, we will list those people who we know to be manufacturing, and their addresses. If we have missed anyone out, let us know!

There are five boards covering the "meat" of the monitor, and in addition there is an optional baseboard, low voltage power board, and an EHT board—all ready etched and drilled. The base-board has the others plugged into it, which means that wiring mistakes are largely eliminated. In answer to the chap who enquires how to get at it for testing, the answer is quite simple: get hold of a piece of *Veroboard* which can be plugged into the edge-connector on the mother board, and at the other end fit an edge connector into which one can plug the offending PCB and twiddle happily at the controls while things are running.

Originally (and indeed with most circuits) we tended to get false sync. due to pulsy noises getting in at the wrong moment; eliminating the problem gives us *noise immunity*, and the current production boards are pretty good in this respect. Earlier designs were lacking noise immunity and brutes to get going to boot.

Build the EHT board first, and get it going: if you are going to have any EHT spitting or arcing it will put your IC's into a low orbit if it happens after the other boards are fitted. In addition there is a tendency for the EHT components to want to spit-over after a period of non-use, and getting the EHT running and driving into the CRT with nothing else connected (except CRT heaters of course!) will give it time to settle down.

The monostable front-end cures our noise problems. Electrolytics may be tantalum types which have much lower leakage; the AD161/AD162 combination can with advantage be changed to use silicon devices, and scan coils and magnetic assemblies can come from an old 405-line TV set along with the line output transformer. Make clear notes of the connections before removing and laying aside for this project, and don't worry if the scan coils are a loose fit around the 5FP7 CRT you have scrounged for this project.

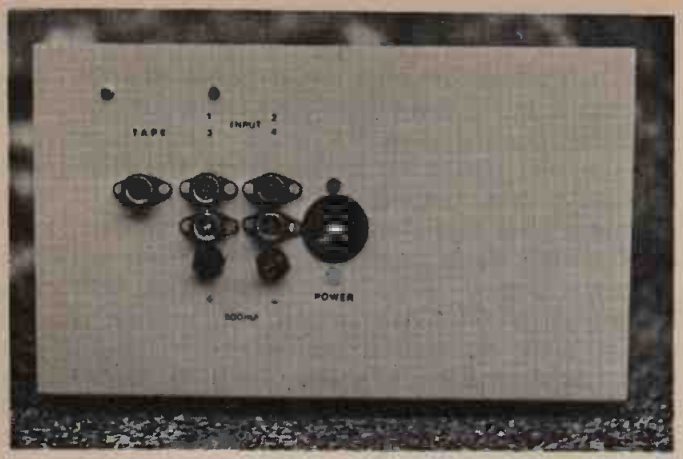
A few points of interest here for builders. The EHT tripler can be held in place with nylon screws, which will prevent any arcs. Note that if your shack gets very cold, nylon screws shouldn't be done up too tight, lest they snap when the cold makes them brittle. On the scan coils, the need for noting which-went-where is evident since they are to be series-fed; the highest-resistance set will be 'Frame,' the other set 'Line'. A minimum resistance of 10 ohms is required after series-ing the pairs, lest your line-output transistors work too hard and die young; if you miss out at this point, and get it wrong, you can have the picture upside down or inside-out, or both at once! More about that anon. Remember we are in effect building an audio amplifier of high gain to be used near a transmitter, so remember to apply good quality RF shielding to, for example, the EHT connections, and decouple all power leads to RF as well as AF. On the timing boards, one must be careful to stick to good capacitors for a linear sweep; polycarbonate and tantalum are preferred.

When setting up, take care. *Switch off* before doing any change, and especially when removing or replacing PCB's.

Monitors in General

By now, we hope, the general idea will have become a little clearer, and the impetuous ones will have dived in and built!

Front view.

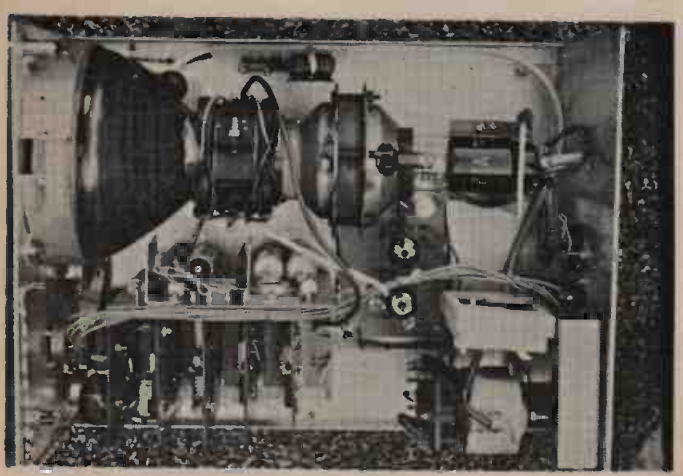


Rear view showing all inputs, and output to a tape recorder.

There are two general types of monitor. The first type has always something on the picture-tube, either a blank raster or a picture. In other words the line and frame timebases are free-running, only being taken over to synchronism when a signal is fed in.

The second type uses a triggered timebase, and so it will have nothing on the CRT until it receives a picture drive.

Since the aspect ratio is 1 : 1 (a square picture) we can easily make up a viewing hood from PCB cut to shape and soldered together. An amber or yellow filter taped to the hood is an advantage if one finds the first blue spot turning yellow confusing and annoying. The sync. pulses and timebases cause the spot on the CRT face to start at the top and sweep 120 times across, each line being below the previous one, until the bottom is reached; the brightness of the spot will meantime be changing as instructed by the video signal, and so we will see a "painting" of the picture build up. The momentary but intensely bright blue is a nuisance as we want to look at the yellow afterglow which is not so bright: hence the filter just mentioned. In the second type of monitor, the spot lurks out of sight in the bottom right-hand corner where it can't do any harm or be a nuisance, and it springs to its proper starting position as soon as a sync. pulse comes along and gets things going. In either type of monitor there is almost always a 'Manual Start' button. G3LPB prefers the free-running type, mainly because one can always see *something* when the monitor is running, even if its only noise! A triggered type can be converted by the simple addition of a couple of unijunction devices and a bit of wiring.



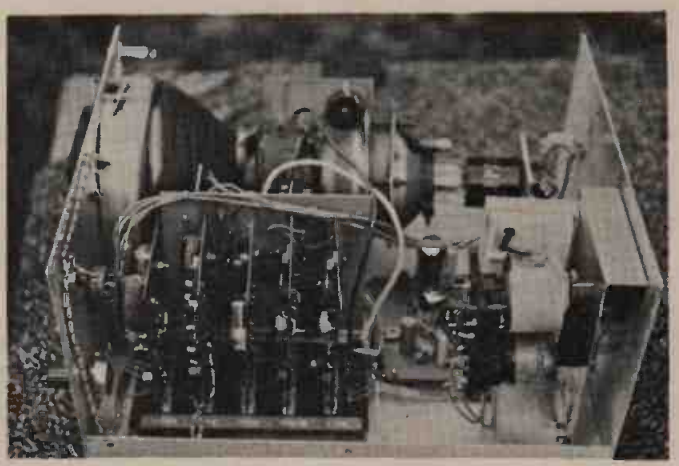
View from above with PCB's fitted.

One doesn't need to be a genius to guess that in either case the size of the raster depends on the settings, so this seems the right time to consider the setting-up procedure.

Setting-Up

Here we revert to consideration of the unit mentioned earlier; we have made and tested the EHT unit, and now we fit the scan coils, with polythene sleeving between the two to give a snug fit, and fixed with a piece of *Sellotape*. The coils should sit snug up to the flare of the CRT, as far up as possible, with insulation between them, and followed by the focus assembly (just as it was on the old TV set from which the bits came). Now, with *no power to the timebases*, one can switch on the EHT, and with adjustment of the brilliance an indication of a spot should be observable. Now turn the focus assembly lever until a spot is obtained, sharp and in the middle of the screen. If you can't, look for a mechanical problem (some focus magnets use an aluminium lever stuck to the magnet which can part and prevent correct operation). The electrical shift pots should be a centre for this.

Now we are well on the way. Switch 'off', and put in the frame board and connect the frame scan coils; set the electronic shifts to centre, and size controls to minimum (slider at the earthy end). Switch 'on', and look for the spot again: the electronic shift controls may have to be used to bring it on screen. It should travel slowly from top to bottom, and a press of the 'Manual Reset' button should cause it to leap back to the top 'start' position and again begin the slow descent. If it travels the wrong way, reverse the coils connection to the board. Some juggling with the shift and size controls will allow a travel covering the whole face of the CRT.



Side view showing PCB's and PSU mounted on rear wall of chassis; the two valves visible are providing EHT.

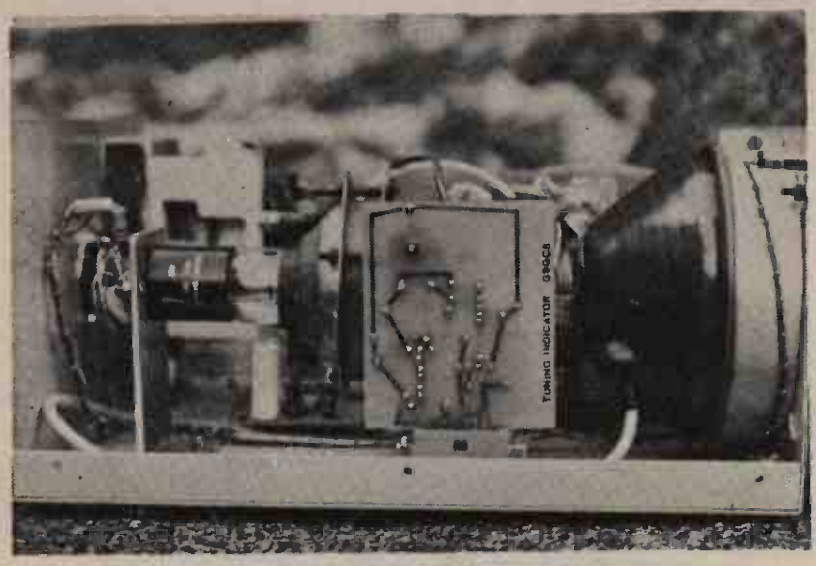
Now, if you are an optimist you can shove in a SS/TV picture from a cassette, and watch for the reset to occur every 7·2 seconds. If it works OK—optimism paid off; if it doesn't, it is *still* OK but we have to investigate a bit first. Take out the frame board and insert the line board, plus limiter-sync. board (set switched off, of course!). Switch on: again centre the electrical shift until you get a spot, again inject signal from the cassette, and twiddle the sync. control (On the *M.K.* unit this is a small pot on the Sync. board, preset).

As this is turned carefully, we will see the spot elongate a little as it starts to accept line drive, so now we can give it size by adjustment of the appropriate size control. We should now have a horizontal line running across the screen: if this is so, we now have the scan coils wired up correctly, and so can tighten up.

Now to the serious business; and we want a tape again, preferably one from a SS/TV station which is known to be a good one. Plug in all the boards, and switch on. Since we have already done most of the work, we are justified in hoping for a spot which we can locate at the bottom right-hand corner, and for at least a raster when we inject the cassette output. We now should see some signs of the screen coming to life; or if a "tuning aid" is being used, flickering of its LED, at least. Careful adjustment of sync., both size controls, contrast and brilliance should now give us a picture, or at least some movement of the spot. If the latter, continue careful adjustments until things look better, finishing off with a final tweak of the mechanical focus assembly to give the sharpest pictures. It really is easier to do than to describe.

Summing-Up

So, that's it. To finish *Part I*, perhaps we should talk

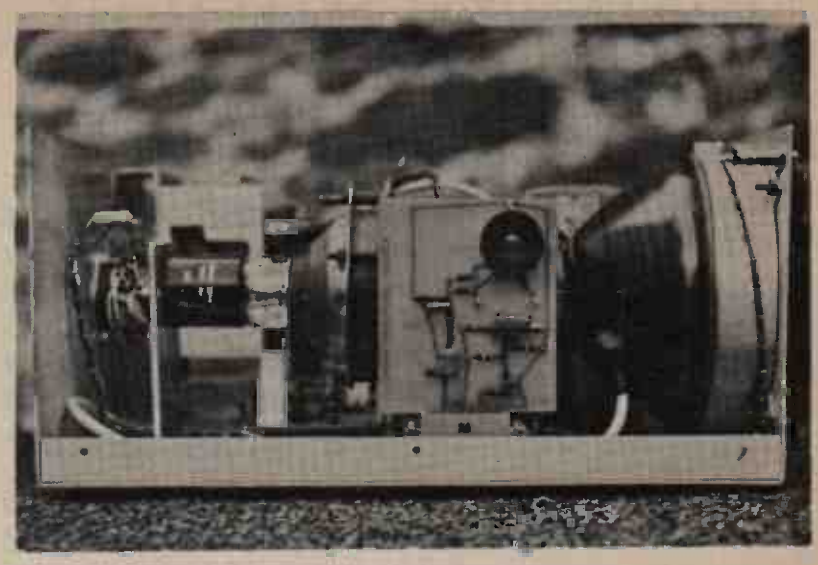


The other side view showing the added 'G8GCS' Tuning Indicator track.

a little about the old 405-line TV components which we have used for the project. First the scan coils: if they are less than the desired resistance, they can still be used by putting in a wire-wound 20-ohm pot in series with each coil, which can be used as a pre-set width or height control or replaced by suitable resistors once the setting-up is completed.

Favourite TV sets to look for are the old Cossor ones of 930 series, Decca's DM series, and the original ECKO series. Some of the older GEC, KB, or RGD sets yield good line-output transformers and magnets, but don't try to use any with more than four windings on the scan coils, as they are too much of a bind to sort out. Triplers can be obtained from BRC sets still in current production, comprising three or five mini-rectifiers with the associated capacitors in a small moulded case which can be fitted to the case of the monitor with nylon screws.

5FP7 CRT's used to be about 7/6d. in "proper" money, but are liable to cost a fiver these days. Another possible tube is a 7BP7 which have been noted at £2



The Tuning Indicator in its correct position in the unit.

recently. They should interchange quite happily, but a few may need to be fiddled with—bear in mind most of them are over 20 years old! Nothing has been said of electrostatically focused tubes, which need completely different treatment.

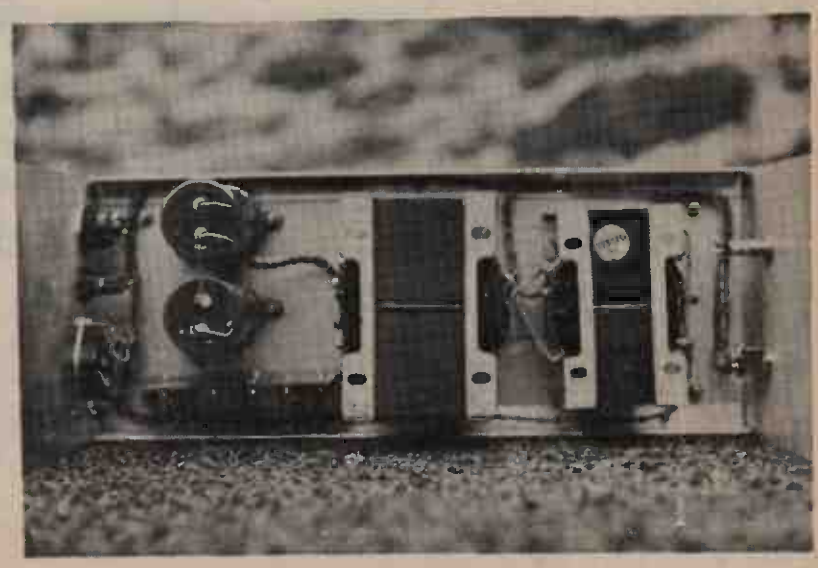
One final point, and we are finished with monitors. It may well be found very advantageous to match the output of the recorder into the input impedance of the monitor; the trick is a mic. transformer or even an old output transformer used backwards, to match the low-impedance 'Ext. Spkr.' outlet of the recorder to the high impedance of the monitor.

We have now covered the Monitor side in essentials; the block diagram at Fig. 1, and the photographs, should clarify any grey areas. Apologising for the pun, we will turn our attention in *Part II* to the transmit side, by way of a flying-spot scanner.

Addresses

For *Venus*, Lowe Electronics, Matlock; *SSM-1* from Spacemark Ltd., Altrincham, Cheshire; M.K. Products are at Belmont, Durham; *Robot* is distributed by Aero & General Supplies, Bramcote, Nottingham; *Hamvision* by Western Electronics, Louth, Lincs.; and of course the British Amateur Television Club, or BATC, who can be contacted at 13 Church Street, Gainsborough, Lincs. All advertise or are mentioned in *Short Wave Magazine* pages.

to be continued



The main power pack.

INDEPENDENT SELECTIVITY SWITCHING FOR THE YAESU-MUSEN FRG-7 RECEIVER

D. W. PHILLIPS

I WAS very impressed with the modification described by Ron Barker in the July 1978 issue of *Short Wave Magazine*. I too wondered what the designers had in mind when they produced this receiver, and could only conclude that they had decided to market this receiver with such a 'barn-door' of an IF bandwidth lest further refinement should threaten sales of their more expensive equipment.

Having established a need for modification, I gazed in admiration at the circuit Mr. Barker had devised and the ease with which it could be installed. Unfortunately, this did not meet my personal requirements, since, as well as being an amateur band listener, I am a broadcast band DX addict; I knew that if I fitted another filter to improve SSB reception, I would feel rather unhappy when listening on AM to know that there was a box of 'rocks' sitting idle inside which could well dig out the elusive DX!

The obvious solution was to be able to switch in either filter from an independent switch on the front panel, but likewise I had neither the courage nor the financial security to drill the front of the FRG-7. The solution was to make use of the existing holes and the method is described below.

Modification

To me, the least useful facility on the front of the receiver is the small jack 'record' outlet. This socket can easily be unscrewed, withdrawn into the receiver and taped to the adjacent cable harness. (If the record facility is a necessity it could be installed in place of the extension speaker socket, or, by drilling a small hole at the back, alongside it. By happy chance a miniature double-pole/double-throw toggle switch such as marketed by *Eagle* fits the resulting hole, and is employed to change over the diode biasing current in the switching circuitry. By making a connection to the 'smooth' side of the choke, a few milliamps of current can then pass directly through a suitable resistance, *via* the switch and through the diodes and associated components; this obviates the need for transistors or tapping the double-stabilised 9 volt supply. The simplified circuit is shown in Fig. 1, the construction of which is on 0·1in. *Veroboard;* its mounting in the disused battery compartment and the final adjustment of the BFO was carried out in the manner Mr. Barker described.

The Toko 2·1 kHz MFL 455 filter employed was purchased from *Ambit International*, 2 Gresham Road, Brentwood, Essex, for £11·95 + VAT, as were the Toko 10mH chokes. T_1 and T_2 are supplied with the filter and should be peaked after installation.

Performance

Performance is very good: SSB reception with the narrow filter is remarkably clear on AM, and although audio response is cut, stations on 60 metres can be read which cannot be heard at all when the wider filter is used. The original filter, of course, produces excellent quality from a strong signal and is also useful in either mode when quickly searching through the bands.

Table of Values

Fig. 1

R1	= 5K6	C1 to C10	= 0·1 μF
R2	= 1K5	C11, C12	= 5 pF
R3	= 20K	L1 to L8	= 10 mH
R4	= 5K1	D1 to D6	= IN4148
R5	= 1KO	T1	= RMC 41996N
R420	= 1K5	T2	= RMC 41997N
R421	= 220K		

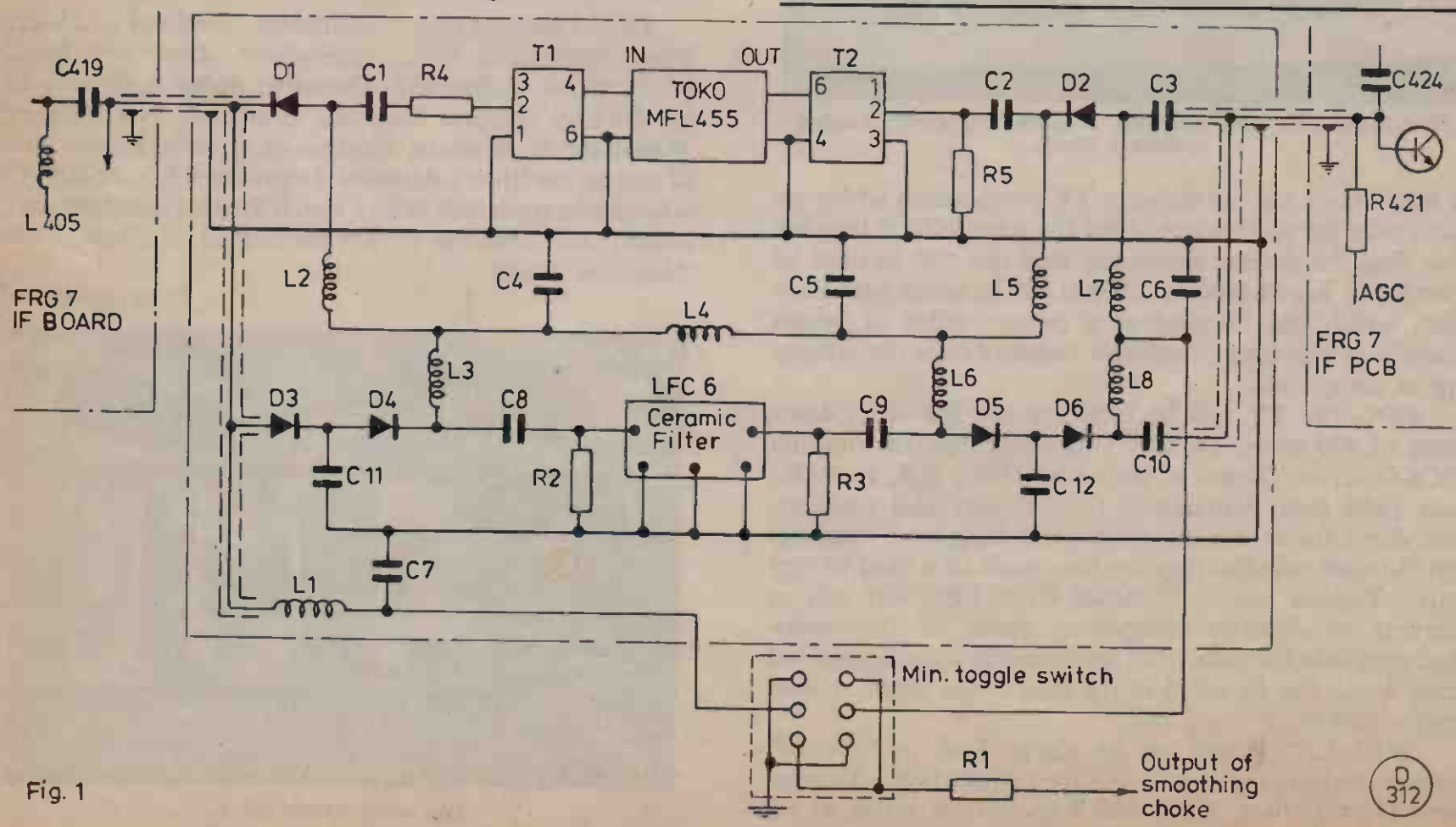


Fig. 1

• • • SWL • • •

SHORT WAVE LISTENER FEATURE

By Justin Cooper

"IT's an ill-wind which blows nobody any good", in the words of that well-known proverb. Our difficulties of recent times have meant that "SWL" has appeared in consecutives issues—and this is something we know many readers would like to see happen regularly. Well, maybe one day. . . .

Quite a serious problem crops up in the letter from *P. Anderson* (*Stroud*) in the form of interference from TV line timebases. This one is a general nuisance, and there can be little doubt that if every SWL—and indeed licensed amateur—who suffers from it on his receiver anywhere between long-wave and 30 MHz were to write a letter to his MP, copy it to Messrs. Callaghan and Thatcher, and making it quite clear that his vote at the next election would go to the candidate who supported legislation to enforce decent design standards, that would be about 40,000 irate letters to be answered and considered. Many an Act has been passed as a result of less pressure!

However, that being said and agreeing that for some 30 years RSGB has maintained the closest watch on the position and has made representations at regular intervals, SWL Anderson still has a problem! We do know that Ron Barker (he of the FRG-7 modification published in the July 1978 issue of *S.W.M.*) is looking fairly closely into the situation, and will be writing up his findings for us, but meantime there are some points to be noted. In general, the problem is worst with colour sets; and often it will be found to be appearing on the SWL aerial just like YI1BGD . . . which is a snag! What it means is that you've got to have access to the TV set if you are to clear the problem. To prove for sure that this is the route the interference takes is easy enough: step one, switch off TV set, QRM goes, so that's the TV set offender defined: step two, with TV set blasting away, put the receiver in the shack onto a dummy load, preferably at the point where the receiver feed normally enters the ATU. If the QRM now disappears again, then the noise is reaching the rig by way of the station aerial. Now, it is a reasonable assumption that the line timebase energy causing the problem is not meant to radiate significantly, so if the noise is bad it must be being allowed to flow out either into the TV aerial feeder (braid or inner) or by leaking out down the mains—whence it is being radiated and picked up by the SWL aerial. There is, of course, just a faint possibility that the set is so close to the receiver that there is direct inductive coupling due to the high field at the line output transformer of the TV. Once the *route* is known, the remedy will normally be fairly obvious, so long as the TV set owner is a decent type. But, it must be stressed, the problem only exists because the TV set-makers under-engineer their products, often for the UK market only, and only legislation can stop tihs.

Next we have another reader with a problem; *Neil Gladwell*, 'The Limit', Station Road, *North Elmham*, Norfolk NR2 5HW, who is right at the starting-post and, first of all, would like to know if there is a club in the area, and any local R.A.E. or Morse arrangements. Neil, with the help of his Scouter who happens to be G8RML, is at work on the building of an eighty-metre receiver. However he is honest enough to admit that it's the operating side which interests him, and construction is a chore on the way towards the intended goal. He wants to get in touch with a club, and so we ask that anyone who can aim Neil in the right direction contact him at the address above; and 'Club Secretary' adds his little bit to the effect that it's a long time since last we heard of a gang in that area—what about a report to this piece?

Another youngster is *I. Scrimshaw* (*Grimsby*) who is looking for data on the *Direx* receiver which we mentioned last time out. Perhaps the best chap for him to talk to is the designer, Rev. George Dobbs, G3RJV, of G-QRP Club fame. Ian, we gather, had his interest sparked off by our reference to the rig as an excellent 'starter' project. The more the merrier.

The Lost Ones

No, not the ones in the poem by Kipling, but the chaps who wrote in for the last SWL, which partially "went west" as a result of having to combine two issues. The writer did his bit, and the copy went off, so all the scores are taken in, but we could hardly justify two 'SWL' pieces in one issue! A pity, the more so in that we recall some rather quotable comments.

The Others

We never cease to be surprised at the letters—the style varies from the 1925-business-letter at the one end to almost pure Damon Runyon at the other; the chuckles varying from the broad to the almost *too* subtle, and the pile is looked forward to each time round for this variety.

We have three letters from *H. Scott* (*Wetherby*) by way of which he brings his score right up to the last day of the year and, in an aside, mentions that he is now listening to 28 MHz on an ex-service Racal receiver.

A rather acid comment starts the note from *A. Twelves* (*Rhos-on-Sea*)—"Ever had the feeling you're progressing rapidly—backwards?" This, we gather was provoked by the near-miss of VR6TC, Tom Christian, appearing on 21 MHz, which is certainly not a daily occurrence. On the other side of the coin, there was the DX-DX net, around 21285 kHz, 1730z, noted on Wednesdays and Fridays, with just about all the continents signing in. Another interesting one is the /MM net on 14120 kHz from about 1815z, mainly yachts at sea.

The matter of the local QRN has been taxing the mind of *H. M. Graham* (*Harefield*), followed of course by some muscle power at the spade, and some shiny new copper to make an all-copper earthing system—works like magic! Just in case anyone hasn't caught on, by making the earth-system an all-copper job, Maurice has removed any junctions of dissimilar metals, which can generate quite a lot of electrical energy by their electrolysis: with the earthing system almost by definition in a nasty environ-

ment, between a corrosive 20th-century atmosphere and an earth of varying dampness and questionable chemical constituents, the electrolysis of dissimilar metals can generate a quite startling amount of noise. If the all-copper answer doesn't appeal, or you have some wire fencing which must be bonded down, then the answer is to cover the joint from all the "nasties" in the ground and air. Paint is probably as good as anything, although one recalls G3KPE having trouble of this sort on a feed-line which he completely covered in silicone-RTV sealant (the stuff that smells of acetic acid) so that the joint could never see the atmosphere; that fix is still good to this day, despite the QRO which sometimes goes up the spout.

That honourable description of putting power to an aerial also describes our position as seen by *G. Brazil* (*Dublin*)—"up the spout." Oddly enough, while Gerard applied it to us, the phrase could also be applied to the situation queried in his HPX list. The VE2's it seems, thought they were entitled to use VZ2 until October 12, 1978, and Gerard heard one. Now, it appears that the VE licensing authority didn't in fact agree the request, but as Gerard says, the VE station was using the VZ2 prefix in *all good faith that it was legal*—so does he count for HPX? Much as it goes against the grain, the answer just has to be 'no', because the alternative would be to leave all sorts of fiddles possible. Another query concerns GB calls; they are perfectly OK if the call is itself a 'good' one and not a repeater. The interesting thought there is that one could argue a case for saying a CW claim for a GB call as the machine in fact sends its call—but 'no' to that as well!

Lateral Thinking is a help in solving problems. This is clearly expressed by *A. Cuthbert* (*Jarrow*) in his solution to an aerial problem. A length of expanding arm-band is tied to the end of the dipole, and the far-end to a bit of string which goes through a block and back to a spindle-and-shaft in the shack. A quick twiddle and the aerial is brought exactly to resonance, and reader Cuthbert says it pays off, particularly with those weak signals which don't move the S-metre at all.

Next we have a licensed amateur, pleading a special case, namely for the /MA calls to count as a separate series. The argument has some force: as Robin says, to come up as /MA is a privilege which doesn't often apply to a G station, and never to a foreigner, and it certainly nets more replies on a VHF CQ than the /MM can ever do. G4DVJ/MM is on 40, 20, 15, 10 and 2 metres, and he is really basing his argument on the VHF aspect because, as he says, the deep-sea G maritime mobiles won't have—let alone use—VHF. However, we hear of so few /MA chaps in the lists, that we don't feel it justified to alter the rules. Incidentally, for those who are interested, G4DVJ signs his /MM from the *City of Winchester* which is a 10,800 ton general cargo and container ship operating between UK and the Continent at one end, to the Persian Gulf at the other.

HPX LADDER

(*All-Time Post War*)

SWL	PREFIXES
PHONE ONLY	
K. Kyezor (Bandon)	2043
B. Hughes (Worcester)	1724
S. Foster (Lincoln)	1692
R. Shilvock (Kingswinford)	1650
J. Fitzgerald (Gt. Missenden)	1552
R. Carter (Blackburn)	1510
E. W. Robinson (Bury St. Edmunds)	1436
M. J. Quintin (Wotton-u-Edge)	1416
M. C. P. Bennett (Datchet)	1385
P. C. Jane (E. Looe)	1375
H. A. Londesborough (Swanland)	1332
J. H. Sparkes (Trowbridge)	1159
H. M. Graham (Harefield)	1105
Mrs. J. B. Jane (East Looe)	1095
M. Rodgers (Harwood)	1030
A. R. Holland (Malvern)	988
D. Taylor (Harborne)	928
P. L. Shakespeare (Foulness)	927
K. A. Burch (Plymouth)	911
M. Law (Chesterfield)	909
B. T. Mackness (Dagenham)	881
D. Brooks (Loughborough)	837
K. Linge (Willington)	813
P. Rooney (Chester)	789
R. Towlson (Nottingham)	764
J. Nicol (South Croxton)	761

SWL	PREFIXES
PHONE ONLY	
D. J. Byers (London N7)	758
M. Shaw (Huddersfield)	753
D. Hill (Crawley)	707
K. Kniveton (Kingswinford)	706
A. Twelves (Rhos-on-Sea)	698
M. Ribton (Oxted)	672
S. T. Bowen (Kippax)	659
D. Robinson (Felixstowe)	646
G. Brazil (Dublin)	635
L. Stockwell (Grays)	626
R. Jacobs (Margate)	617
P. Leather (Camberley)	552
D. C. Casson (Reading)	537
R. C. Mackay (New Romney)	516
T. Anderson (Stroud)	504
D. G. Sim (Southampton)	508
Mrs. J. Brooks (Loughborough)	500
CW ONLY	
H. A. Londesborough (Swanland)	1124
D. W. Waddell (Herne Bay)	836
J. H. Rosling (Bakewell)	750
H. Scott (Wetherby)	674
P. L. Shakespeare (Foulness)	671
K. Kniveton (Kingswinford)	310
D. L. Hill (Crawley)	298

Minimum score for an entry is 500 for Phone, 200 for CW. Listings in accordance with HPX Rules, and to include only recent claims. A "Nil" return is permissible in order to hold a place.

Now to *B. Hughes* (*Worcester*) who wonders somewhat wistfully whether he would get his copy faster if he subscribed direct. Definitely so under all "normal" conditions, as the hold-up is almost invariably in the distribution process: a direct subscription requires only one process—mailing—whereas buying from your local newsagent can involve up to three. Although, on the topic of the postal system, this winter of general industrial disrupton has brought us to the point where a letter posted first-class from the local hospital to the writer, all of a mile away, took *five working days* to arrive; and three days seems about par for the course for first-class mail generally. On the other hand, this "winter of our discontent" is most definitely *not* normal!

Under the name of *D. Casson* (*Earley*) the November 'SWL' carried a comment about UK1 prefixes—just in case anyone was confused we were talking about UK not U.K.! It cost Derek dearly though, as some twelve had appeared in his HPX listings—but even after the amendments have been made, he's still through to the HPX All-Time table.

K. Kyezor (*Brandon*) writes from a new QTH, which he reached after a bit of a struggle in time for a Christmas amid the packing-cases. Even so, move or not, SWL Kyezor is the first one to reach the major 2000 mark. Interesting thought, isn't it, that when your conductor first came to this task years ago, it was reckoned that a "possible" was around 1400 prefixes at most. Since then

April issue will appear on Friday, April 20th.

ANNUAL HPX LADDER

Starting date, January 1, 1978

SWL	PREFIXES	SWL	PREFIXES
K. Piper (Bognor Regis)	486	C. Stevens (Derby)	226
J. Doughty (Birmingham)	486	R. G. Williams (Borehamwood)	218
B. L. Henderson (Chetnole)	473	B. Musselwhite (Warminster)	205
K. M. Rogers (Lutterworth)	364		
P. Matthews (Eastwood)	283		
S. Farkas (Birmingham)	247		

200 Prefixes must be heard for an entry to be made, all since January 1, 1978. See also HPX Rules.

there has scarcely been a month without a new prefix being invented. But with all that, congratulations from us all, K.K.

D. G. Sim (*Southampton*) has changed to a FR-50B receiver, and finds it quite an improvement both in sensitivity and selectivity over its predecessor; and the bands have been doing their part too, taking Don out of the 1978 and into the All-Time list. An odd one was 21A6XSH on 21 MHz, claiming that the 21 was a district ident. He's no more than an A6 to us, though, and even then a rather doubtful one, as we suspect this one is a phoney.

Another one having a moving time is *D. Brooks* and his XYL Judith (*Loughborough*). One of the snags was the loss of his copy of the last list sent in; but as luck has it we can lay hands on ours, and so the problem is easily sorted out. On a different theme, Dave remarks how the band conditions perk up a little when everyone is on holiday—which just goes to prove that "conditions" and "activity" are oft-times the same word! The 28 MHz band is a prime case: during sunspot minima, people will say they've never heard a signal at all on the band, and nearer the peak, as now for instance, one may often put a CQ on to a "dead" band, and get a call back from the other side of the globe.

E. W. Robinson (*Bury St. Edmunds*) seems to have kept up his steady level of activity, with quite a nice crop of interesting prefixes; but son David in Felixstowe has a 'nil' report while *he* goes through all the trauma of moving.

Yet another mover is *M. Ribton* (*Oxted*) although in his case the task was still ahead of him when his letter was written. Mike comments that everyone continues to be impressed by the FR-101; on the other hand he put up a quad to listen to GB3LO one Saturday night, and having listened he says he won't listen to that again until he has it in writing that the cretins have been put out of business.

The autumn was a busy one for *P. L. Shakespeare* (*Foulness*) with not much time for hobbies. However, the FRG-7 has had the Ron Barker mod. with pleasing results, and lots of QSL's have come in—ZD7SD and ZD7WT both landed on the mat on the same day, so they must have travelled all the way from St. Helena together.

M. C. P. Bennett (*Datchet*) has found the bands quite good; he wonders about the "echo" effect sometimes to be heard on signals generally. Without actually *hearing* the effect he is talking about, it isn't too easy to be sure, but it is probably effect which results when a signal first reaches the receiving aerial and then continues on for a complete further circuit to be heard again with a delay equal to the time taken to circle the globe. One doesn't have to be a genius to realise that the exact delay time is a factor dependent on the precise route the signal takes between ionosphere and ground on its way round—there may be umpteen hops, or propagation may be largely all up in the ionosphere which would give a different time. However, for all practical purposes a time of about 1/7 second is near enough. The experimenters among us may care to design an experiment, now that good timer-counters are in many shacks, with a view to trying to define the route taken by a particular signal; there is certainly some evidence to suggest it doesn't always behave in the simple "first principles" manner set out in the R.A.E. course.

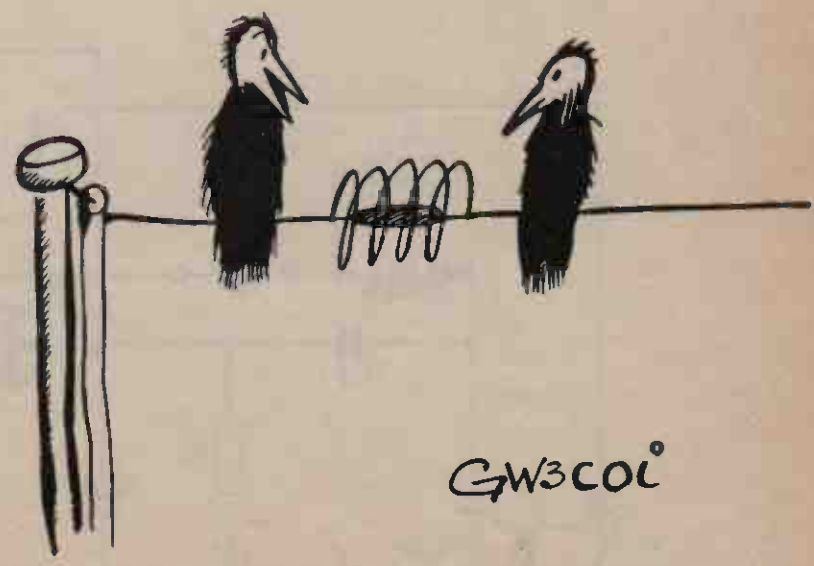
D. Taylor (*Harborne*) is another to be a bit frustrated by all our troubles, but nonetheless he kept an ear to the receiver and his totals rise accordingly.

A change in his business arrangements have knocked a severe dent in the listening time for *B. Henderson* (*Chetnole*), and he now can only listen around 0645 and 0715 when the higher bands are pretty well dead; a shift to 3·5 to 7 MHz might be profitable in such a situation.

Dave Hill (*Crawley*) harks back to the decision to let *Oscar* contacts in to the HPX Ladder. We must make it quite clear though, that we are only talking about *Oscar contacts*. That means, if you're on the downlink frequency, staying there until both ends of the QSO are logged—otherwise it would be merely a hearing of *Oscar* doing half his thing.

Other Letters

Firstly, of course, all those who were mentioned in the now-gone January/February piece; and all those we have mentioned so far this time. In addition, we have notes and scores from R. C. Mackay (New Romney); P. Matthews (Eastwood); M. Law (Chesterfield); J. Doughty (Birmingham 44); and R. Shilvock (Kingswinford). Thanks to you all for your reports and letters —they make a vital part in the life of your old J.C. who wouldn't feel right without 'em nowadays! Deadline for next time will be March 22, addressed as ever to your scribe, "SWL," SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ.



". . . can't see how that could trap anybody . . ."

SOME EXTRA BITS AND PIECES

MORE TOYS FOR EXPERIMENTERS!

OPERATING crystal-controlled low power rigs in the A1 mode can, unless a large number of 'rocks' are available, sometimes prove exasperating—for inevitably the clear channel selected suddenly becomes alive with QRO signals seemingly determined to make a CQ call or existing QSO impossible. Despite this, however, there is considerable interest in low power CW working which does confer a degree of personal satisfaction unknown to SSB QRO boys!

Sliding clear of the occupied frequency spots for which crystals are available can usually be overcome by incorporating a VXO, which although by no means as versatile as a VFO has none of its vices; after all one remains virtually 'rock bound'!

Circuitry

The VXO arrangement shown in Fig. 1 is a useful one capable of providing a stable 'pulled' frequency swing of up to 4 kHz at 7 MHz—say 7010—7014 kHz—using a type HC6-U crystal; this represents swings of 8 and 12 kHz at 14 and 21 MHz respectively when doubled or tripled.

Just two field-effect transistors, a coil and a palmful of small components are needed for the device, and where Tr1 operates as the prime oscillatory mover with Tr2 working as a buffer amplifier. Output can, if required, be fed into the VFO socket of the crystal-controlled transmitter shown in Fig. 1 of the August 1978 issue of this journal (p. 360), or used in other connections. Clearly there is no need to calibrate the VXO tuning control if the associated receiver is itself able to show the operating frequency, as most decent amateur bands communications type receivers can, nor is it necessary—except for purists—to have enough crystals available to cover the whole 7 MHz band CW segment.

If the main interest is in the 21 MHz band it might be possible to fit a coil pre-tuned to the frequency in place of R5 to enhance output, but this has not been tried; alternatively a further stage of amplification could be added if required.

Constructional

Physically, an oddment of copper-clad board can be etched (brief details regarding etching such a board can be seen in the August, 1978 issue of *Short Wave Magazine*, pp. 362-63) to agree with Fig. 2 and this will carry every item. Although not ideal for the purpose a small twin-gang air-spaced variable capacitor without trimmers as found in some transistor radio receivers (208 x 176 $\mu\mu$F) can be pressed into service for VC1 making Section (*a*) the largest of the two. For L1 some 40 turns of fine enamelled copper wire close wound on to a 0·3in. dust-cored former is about right with crystals in the 40-metre band.

The plain side layout of the board is shown in Fig. 3, most of the components just being pushed through and soldered to the appropriate copper portions. The completed board can then be attached to a slightly larger metal panel, *see* Fig. 4, using spacers cut from discarded ball point pen cases and allowing just the variable capacitor shaft and the top $\frac{3}{8}$in. of the crystal housing to project; the panel size will depend on the size of the metal box which will finally house the unit.

Testing

When the unit is functioning correctly it consumes but some 5mA., safety bias being conferred automatically by oscillatory action. The first step, therefore, is to monitor the current to see that it is low in value over the whole capacitor swing; a high current reading denotes

Table of Values

Fig. 1

C1	= 100 $\mu\mu$F	R2	= 100,000 ohms
C2	= 100 $\mu\mu$F	R3	= 270 ohms
C3	= 0·02 μF	R4	= 330,000 ohms
C4	= 150 $\mu\mu$F	R5	= 4700 ohms
C5	= 1000 $\mu\mu$F	R6	= 270 ohms
C6	= 0·02 μF	RFC	= 1mH miniature choke
VC1	= *see* text		
X1	= *see* text	Tr1,	
R1	= 27,000 ohms	Tr2	= 2N3819

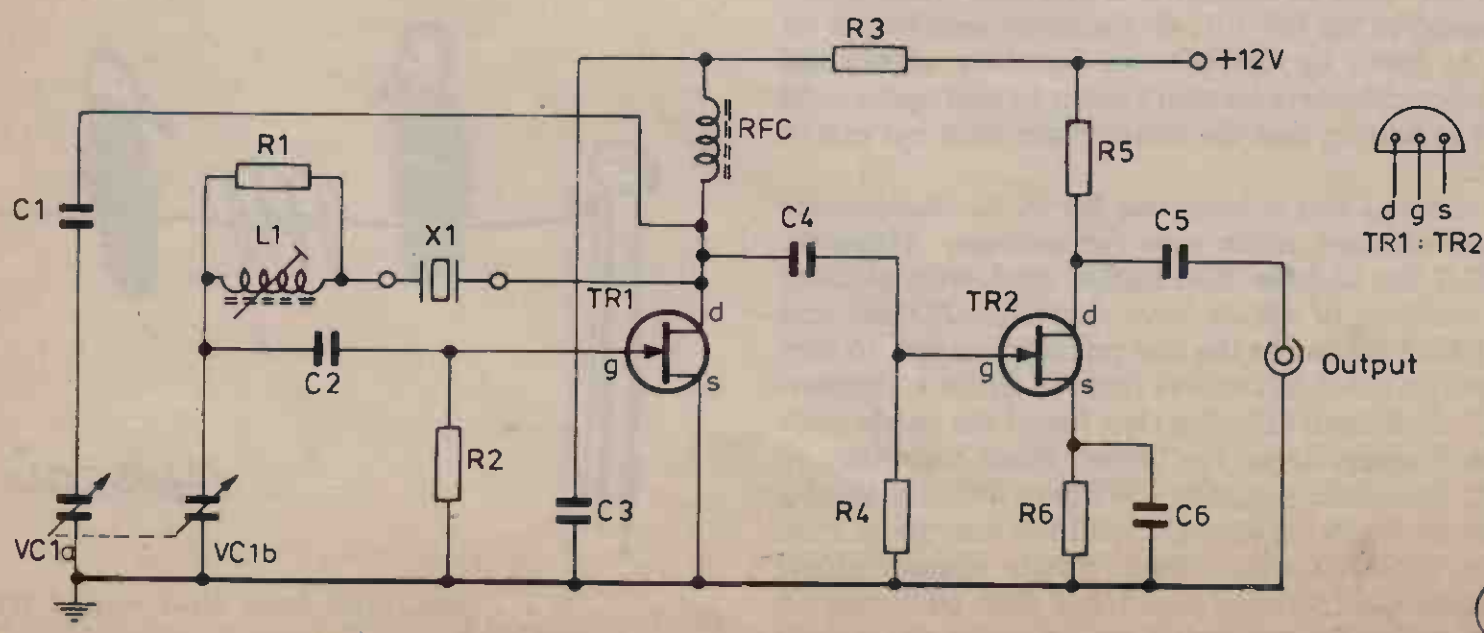


Fig. 1

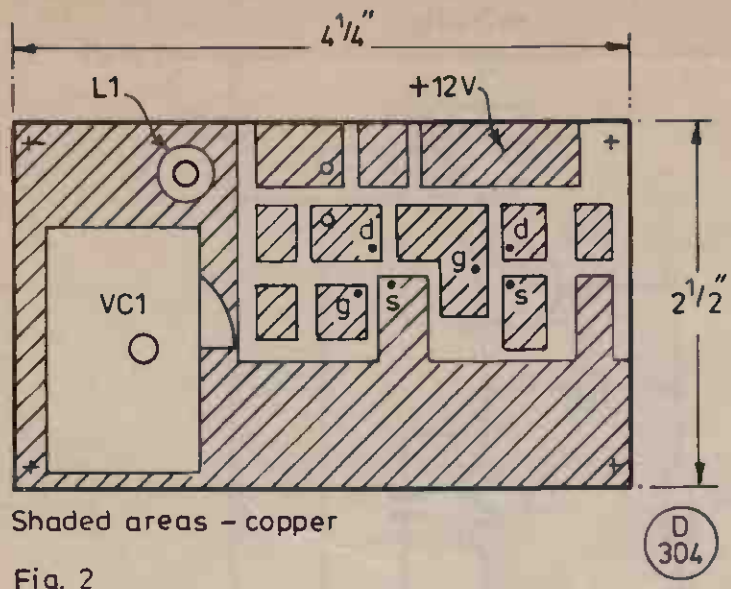


Fig. 2

a fault of some kind. Note, too, that the VXO must be switched off whenever the crystal is changed for the reasons just stated.

Power for the device can initially be provided by a 9-volt battery; later on the 12-volt regulated supply provided by the unit shown in the February 1978 issue of this journal, p. 738 (Fig. 5) would prove satisfactory.

An FET Top-Band Converter

Although frequency converters usually lower the received frequency for subsequent amplification, this is not always entirely essential and it is also possible to go the other way. In the Transverter described in *S.W.M.*, February 1978, p. 736, for example, the 14 MHz band is utilised for Top Band working by employing locally generated oscillations at 12·2 MHz. Other bands available can also be used for the purpose, even the 21 MHz band as the circuit of Fig. 5 shows. This little item took but three evenings work to put together—which included winding the coils—and it fired right away at switch-on; admittedly a reliable and accurately calibrated dip-oscillator was to hand to pre-resonate the coils. In a case like this it is more a case of making Top Band available rather than one of securing amplification.

A pair of easily-obtainable FET's used in grounded source connection work as the Mixer and Oscillator elements with RF signals at 1·8-2·0 MHz applied to the Gate of Tr1 *via* L1 and trimmer capacitor TC1; no aerial link winding is needed due to 'bottom-ending' the coil L1.

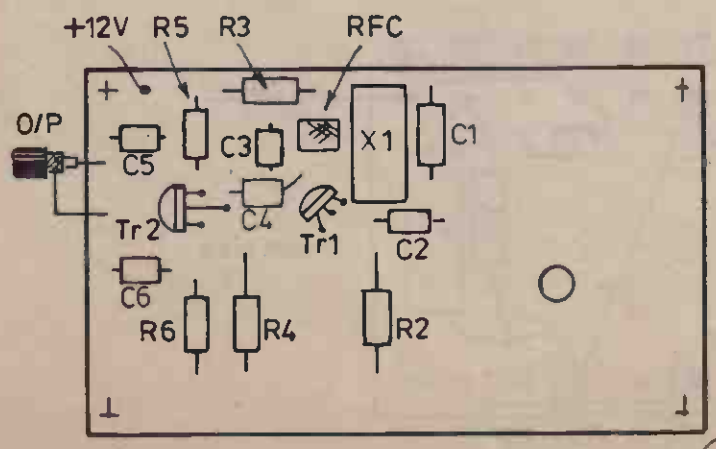


Fig. 3

The primary winding of transformer T1 in the drain circuit is pre-tuned to the 21 MHz region and a coupling winding conveys the converted signals to the associated receiver. In the oscillatory section around Tr2 signals are generated at 19·2 MHz and these are fed to the source of Tr1 for mixing with the Top Band input. Coil L2 is tuned to the crystal frequency—6·4 MHz—and T2 primary to the third harmonic.

Sensitivity without any RF amplifier is adequate and selectivity due to the 'bottom' connection is good, TC1 pre-setting the part of the band in which the majority of activity takes place—say 1·83—1·93 MHz; a physically larger variable component could also be used if required. The converter output permits 'forward tuning' on the associated receiver in that 1·8 MHz corresponds to '21' on its scale.

As an alternative, Top Band signals can be brought to the 14 MHz band by using a 6·1 MHz crystal trimming L2 to this frequency and adjusting T2 to 12·2 MHz. In this case T1 will be peaked for output at 14 MHz and again 'forward tuning' of the associated receiver will result—1·8 MHz corresponding to '14' on its scale.

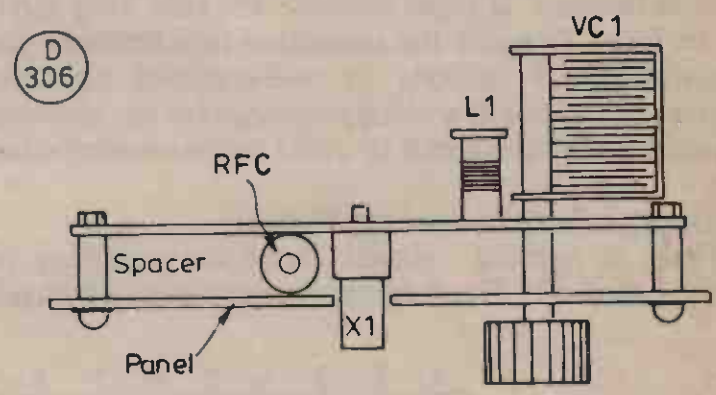


Fig. 4

Construction and Adjustment

The assembly can be accommodated on a small 18-way tag board as shown in Fig. 6, with the aerial coil held securely in a vertical position with *Araldite;* coil details are shown in the Table of Values for Fig. 5.

To adjust the unit, one end of R3 is temporarily disconnected and 9v. applied from a battery *via* a test-meter set to read 0-10mA. The core of L2 is then adjusted until the indicated current suddenly drops to a low value of, say, 300 μA. The crystal oscillator is now functioning which may be proved by touching the crystal, or L2, with a finger whereupon the current indicated should rise. The supply is then switched off and on a few times to ensure the oscillator 'fires' readily; should it not do so, the core of L2 needs a 'fly's leg' readjustment! The core of T2 is then adjusted to provide an even smaller current reading, and a passive wavemeter set to the 19 MHz region—if brought close to the transformer as a 'sucker'—will show whether or not the coil is correctly tuned to the appropriate harmonic.

With the oscillator going, R3 is re-connected and output applied to the associated receiver *via* a short length of screened cable. Prior to connecting the aerial the core of T1 is manipulated to maximise noise in the receiver; thereafter with receiver controls backed off slightly, Top Band signals should come through when

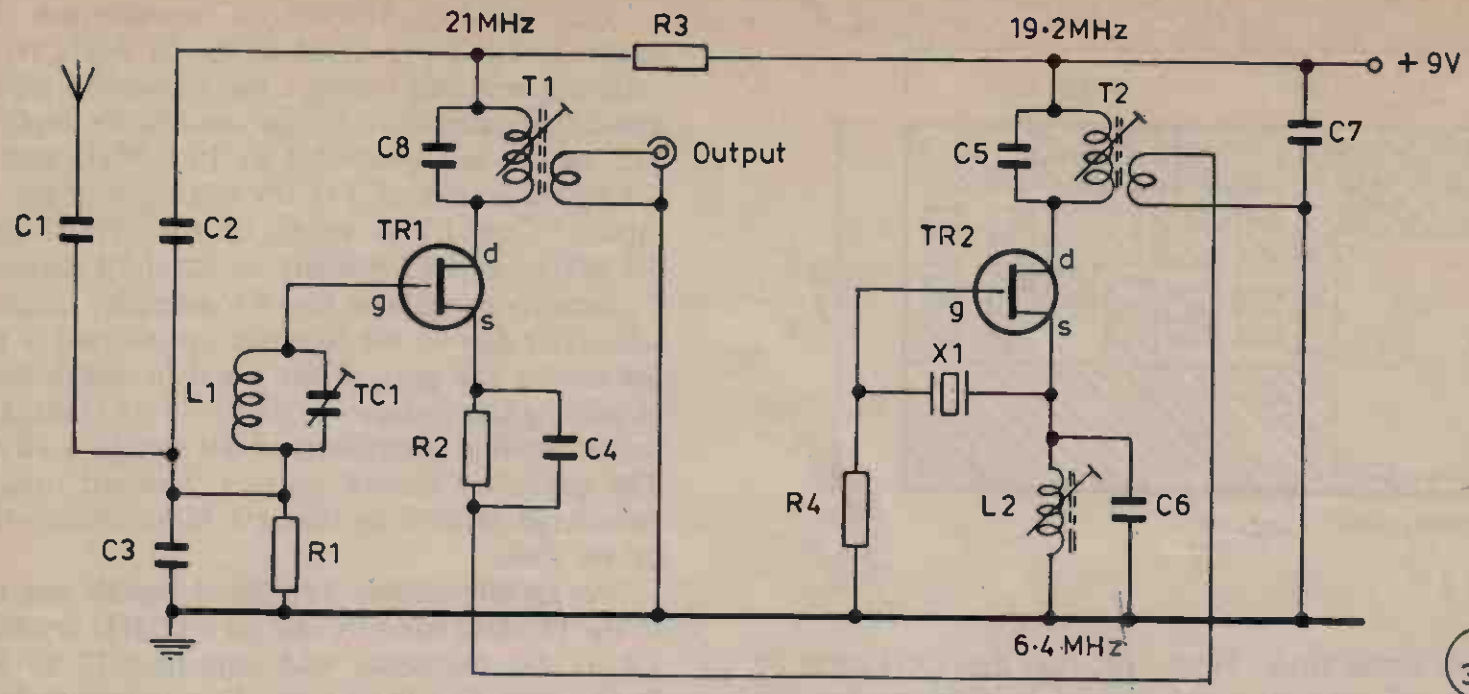


Fig. 5

the aerial is connected whilst tuning around 21-21·2 MHz. Trimmer TC1 is then peaked on a signal at approximately mid-scale, or otherwise as preferred, and if 'breakthrough' is experienced a suitable 'trap circuit' can be fitted to reject the unwanted interference. Such breakthrough is unlikely in well-screened apparatus, which indicates use of a metal container for the converter; it should not be too small to avoid any de-tuning effects.

Pocket Size Aerial Matching Unit

There is nothing unusual about the matching unit circuitry shown in Fig. 8 except perhaps its small physical size; this is governed almost entirely by the size of the receiver-type variable twin-gang tuning capacitor (2 x 470 $\mu\mu$F nominal) for VC1.

The simple L-match arrangement has been around for years and enables end-fed aerial wires of virtually any length to be matched into low impedance HF bands transmitter outlets; actually, it is nothing more than an extension of the usual transmitter pi-network outlet. When carefully adjusted, random length aerials can be made to give excellent results SWR-wise—and this includes the once familiar Windom type. Just how much power can be fed to this pocket-size version is unknown

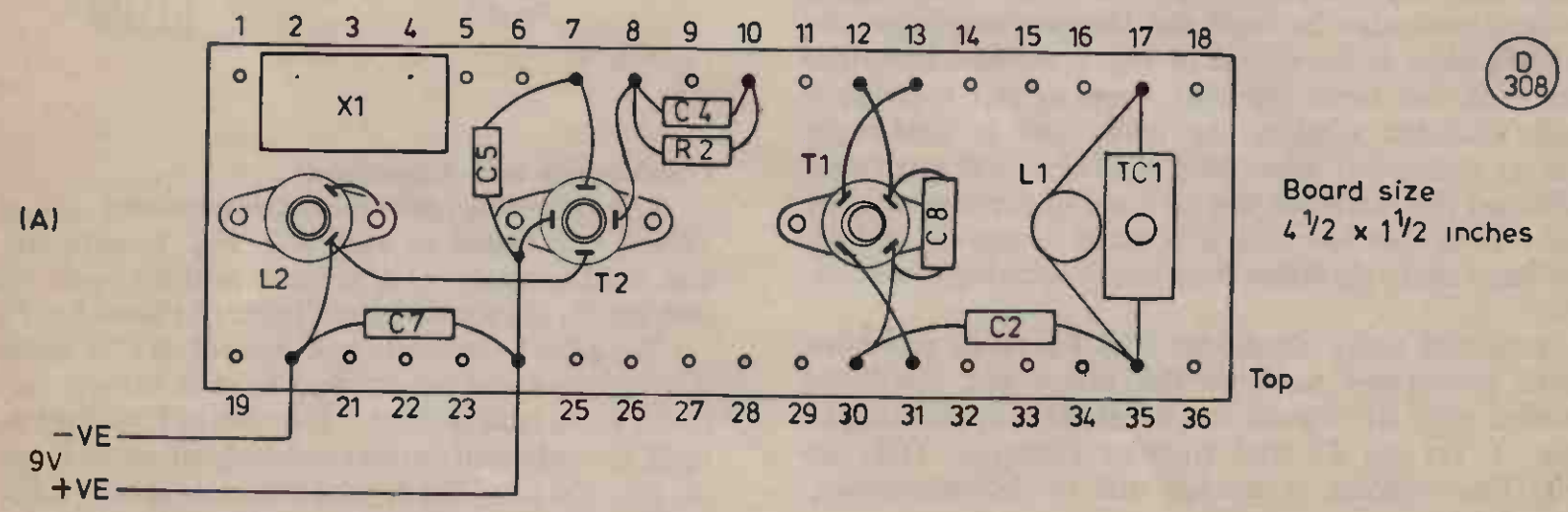


Fig. 6

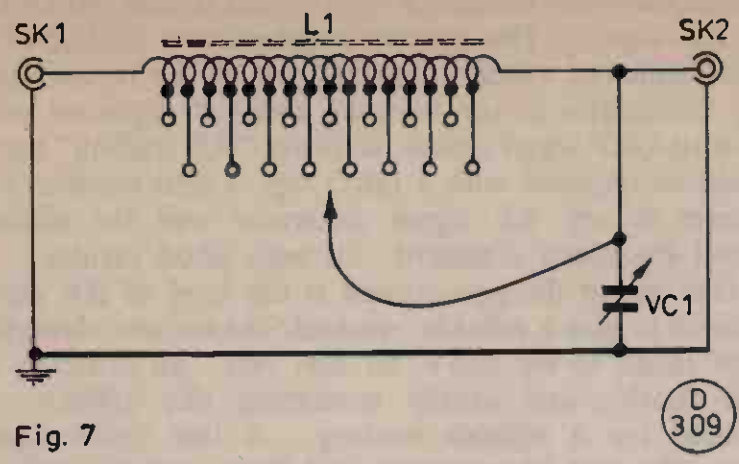


Fig. 7

Table of Values

Fig. 5

C1	= 1000 $\mu\mu$F cer.	R1	= 10,000 ohms
C2, C7	= 5000 $\mu\mu$F cer.	R2	= 4700 ohms
C3	= 2000 $\mu\mu$F cer.	R3	= 180 ohms
C4	= 10,000 $\mu\mu$F cer.	R4	= 470,000 ohms
C5, C6	= 47 $\mu\mu$F s/m	Tr1,	
C8	= 68 $\mu\mu$F s/m	Tr2	= 2N3819
TC1	= 140 $\mu\mu$F trimmer	X1	= 6·4-6·5 MHz (or *see* text)

Table of Coil Data

L1 = 52 turns 34 *s.w.g.* enam. closewound on $\frac{3}{8}$in. dia. x 1in. long oddment ferrite rod over a layer Sellotape.

L2 = 42 turns 34 *s.w.g.* enam. on 0·3in. T-base poly-former with dust core.

T1 = *Primary:* 11 turns 30 *s.w.g.* enam. *Secondary:* 4 turns thin d.s.c. wire over end of Primary associated with R3, over double layer Sellotape on 0·3in. dia. poly-former with dust core and tag ring.

T2 = *Primary:* 12 turns 30 *s.w.g.* enam. *Secondary:* 6 turns thin d.s.c. wire over 'hot' end of Primary, over double layer Sellotape. Former as for T1.

All windings are close.

but must be governed partly by the vane spacing of VC1, and partly by the saturation level of L1 'former' which is a 1½in. ferrite ring of unknown characteristics obtained at one of the mobile rallies. There is certainly no problem when running QRP from a HW-8 transmitter/receiver, or when pushing 25 watts!

The ferrite ring is wound symmetrically with some 25 turns of tunned copper wire of around 24 *s.w.g.* over a layer or two of *Sellotape*, the cross-section of the ring being ¼ x ¼in. Finally each turn is tapped with a short 'spike' soldered on as indicated in Fig. 8, and the spikes can be selected as required by a small crocodile clip and lead attached to VC1. In use socket SK1 is connected to the transmitter RF outlet preferably through a SWR indicator as shown in Fig. 9 whilst SK2 is in connection with the normally high impedance aerial end-fed wire.

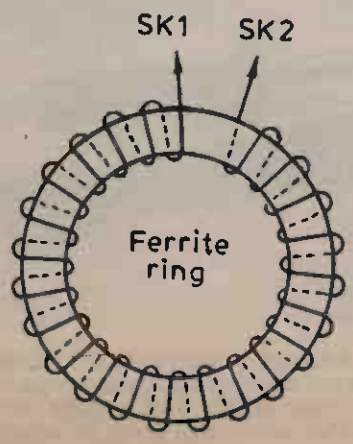


Fig. 8

Adjustment

Although the AMU can match over a wide range of impedances it is better to use that for which the transmitter is designed. Initially therefore the link at 'X' (Fig. 9) is removed and a dummy load to suit the transmitter—say 50 ohms—is applied between points 'A' and 'B'; the transmitter is then loaded for maximum output as indicated by the SWR meter in its 'Forward' position. Subsequently the dummy load is removed, link 'X' reinstated, and the SWR indicator switched to 'Reverse'. The aim is then to make the SWR meter read zero or thereabouts without in any way re-adjusting or altering the transmitter controls, selecting tappings on the AMU coil in turn whilst manipulating VC1. Although this procedure must be followed initially for each band the best settings soon reveal themselves, and usually it is found that the croc. clip ends up nearest to socket SK1 for the higher frequency bands and tends to move towards SK2 as lower bands are selected. On any band however if this method has been adopted it should be found that maximum and minimum readings on the SWR meter agree with the 'Forward' and 'Reverse' switch positions respectively—and the transmitter is seeing its proper load.

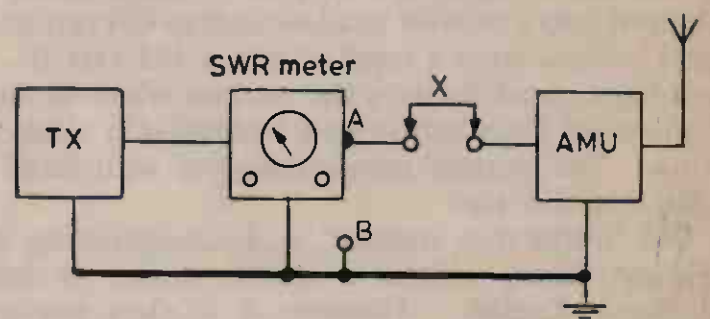


Fig. 9

If no SWR meter is available—as in SWL stations for example—adjustments can be made aurally for maximum received signal strength which can rise very significantly, often making a seemingly quiet band really come alive!

REVIEW

MODEL FC-5M FREQUENCY COUNTER

REV. G. C. DOBBS, G3RJV

HAVING had a couple of abortive attempts at building a frequency counter for the G3RJV station, my attention was caught by the miniature FC-5M Counter offered for sale by Lowe Electronics Ltd. in *Short Wave Magazine*. Living quite close to Matlock, I decided to call and look at the counter, and left the shop with one.

Physically, the counter is very small: the "black box" measures some 90mm. x 27mm. x 80mm. The circuit is built around an I^2L integrated circuit arrangement with 3 IC's and a 10 MHz crystal standard. The readout, to 50 MHz, is from five 7-segment LEDs, and the power requirement is 12v. DC with an extra power input point to allow the unit to be run from 5v. DC if required. The frequency input is *via* phono sockets. The counter may be fed directly with the required frequency to be measured, but also has a useful -455 kHz offset which allows it to be tapped into a receiver local oscillator; this can provide digital readout from a receiver with a 455 kHz IF. The small front panel displays the readout which is flanked by an on/off push button and Normal/-455 mode push button. The counter comes complete with leads in a rather splendid box.

The 'instruction manual' is a disappointing single duplicated sheet, without a circuit, written in dubious 'translated' English. However it is clear enough to ensure basic use of the counter, although it does contain a teasing reference to the point the unit could be simply converted for use with a 10·7 MHz IF, but prefers to keep the method secret.

Wishing to press my 'new toy' into use, I quickly hooked it to the 12v. supply and wound about 10 turns around the outer sheath of my trapped dipole (20-15-10) for RF input. The counter worked well and gave a clear frequency readout on load up of the transmitter. The transmitter in use was the Ten-Tec *Argonaut* with a 5-watt QRP input power, so fewer "RF sniffing" turns would be required with a QRO rig. I also coupled the counter to my RF signal generator and the station crystal frequency standard—all with good results.

One minor disappointment is the level of RF input required to give a reliable readout: the makers claim the input range to be 20mV. to 20v. *rms*. In practice, at least 50mV., and ideally something like 100mV., is required for a reliable reading. A low input signal causes the unit to miscount and hunt, but the makers do supply a simple graph which shows that over about 5 MHz, the required input rises sharply.

A small external pre-amplifier seemed a good idea and the simple circuit in Fig. 1 was lashed up and helped a great deal. This circuit, which has done the rounds of the amateur world, was part of one of my earlier home-brew frequency counter attempts. Conveniently, the 12v. input is regulated within the counter, to produce the required 5v. for the IC's. When the unit is switched on with a 12v. supply, the 5v. input screw is at 5v. making it usable for powering an external pre-amplifier.

In conclusion, I would rate the FC-5M Counter as a good buy for the money. It has performed well for several weeks, and in addition to being a useful station frequency monitor, I feel sure it will prove its worth as an item of test equipment. It seems likely that a simple pre-scaler would be a useful addition, as is a pre-amplifier, but the lack of circuit information is inconvenient.

Tables of Values

Fig. 1

R1 = 2·2K	C1 = 0·1 μF
R2 = 470 ohm	C2 = 0·01 μF
R3 = 18K	

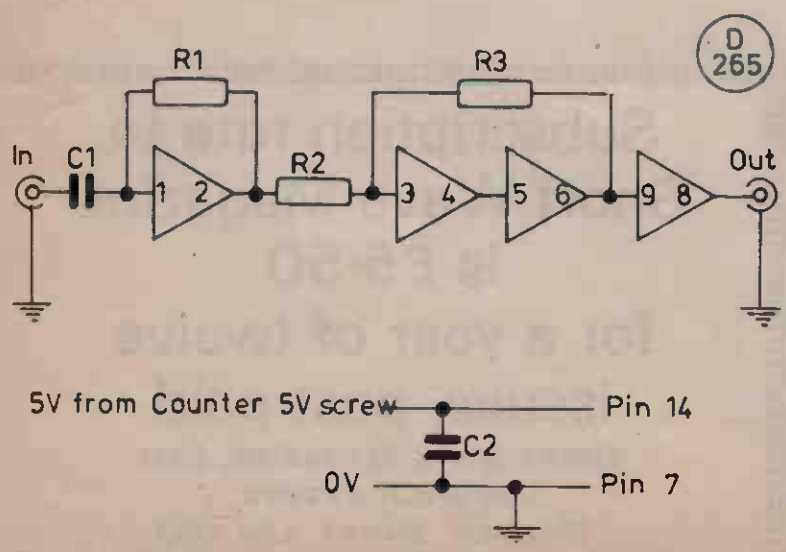


Fig. 1 FREQUENCY COUNTER AMPLIFIER CIRCUIT

David Griffin Ltd. has produced this soldering kit, which includes a 25-watt soldering iron, a spare fine work bit, a reel of multi-core solder and a pair of tweezers, for a cost of £4.50. The soldering iron is available separately, price £3.50.

COMMUNICATION and DX NEWS

E. P. Essery, G3KFE

Congratulations

NEVER can the RSGB—or any other society—have given the writer so much pleasure as they have done so far in 1979. First and foremost by twisting G5VT's arm to accept the award of the ROTAB Cup to mark his long and consistent career in the DX field. It's interesting that such a frail-looking and retiring man should be at the top of the tree in both his working life and his hobby of amateur radio; and those of us who are lucky enough to be on visiting and telephone-talking terms can testify what lies behind that retiring facade. We guess that G3FKM, G3HCT and G2BVN were at the back of this award, as one would need to be a DX-er to know about G5VT.

Next, RSGB again, in that we understand that they are taking over the printing arrangements for Geoff Watts' *DX News Sheet*, leaving Geoff time to concentrate on culling the news, and relieving the strain on his eyes caused by the concentrated effort.

Thirdly, yet again RSGB, in the choice of G3HCT as their 45th President, and in publishing an article of his on Aerials which make clear his determination to excel as a DX-er. Perhaps this choice will help to redress the balance in the U.K. which has swung violently too VHF-wards—recognising that, in the last analysis, it is only at HF or through *Oscars* that amateur radio can remain international, rather than parochial.

Conditions

Mention the egg of the curate and you have it; but at its very lowest, infinitely better than at the null of the sunspot cycle in 1976. Ten has been open on the odd occasion to DX at surprising hours, and it still seems to have that wonderful power of yielding the unexpected. Put out a CQ on a band lacking in all but TV timebases, and have a DX signal come back at S9-plus; or on the other hand, find your man disappear in mid-over as the band closes almost in seconds. Never a dull moment!

Of course, all this sort of thing at the top end has to have an effect at the other end, so Top Band for instance, is not as good as it has been. But yet again, it is a matter of the operator rather than the band, as GM3IAA demonstrated by his WAC with a genuine ten watts from Inverness, a place which one would have thought to be pretty impossible for an attempt at WAC; indeed, completing a WAC by two QSO's with VK6HD after a summer win in the Veterans Tennis Doubles at Grantown, at the tender young age of 81, must rate a mention in the *Guinness Book of Records*.

The News

Here we must start with the letter copied off to us by *Lowe Electronics*, to whom it was sent. Brian P. Collinge is the writer, and he indicates that Nigeria will probably be back on the air soon, with a revised series of prefixes, which will be by States, as follows: 5NØ to Lagos and Abujo; 5N1 to Ogun and Oyo; 5N2 to Kwara and Niger; 5N3 to Ondo and Bendel; 5N4 to Rivers and Anambra—the latter is where Brian, in Enugu, is based; 5N5 to Imo and Gross Rivers; 5N6 to Gongola and Bauchi; 5N7, Burno and Kano; 5N8, Bemie and Plateau; and 5N9 for Kaduna and Sohoto. There are active clubs in 5NØ, 5N1, 5N2, 5N4, 5N5 and 5N9, Brian himself being secretary to the Anambra state club and the Anambra Scouts A.R.C.

Next we move on to G3CED (Broadstairs), and in his log we note everything at two watts CW, all five bands, and interestingly enough George now has his five-band radial system organised and is playing with a loop aerial on Eighty, all being done in between the work of running a business. Eighty showed the loop and the Joystick in straight comparison with G4CZG in Herne Bay—Joystick 579, loop 339—clearly more work is yet to be done. 7 MHz offered lots of contacts around Europe and the UK: one of considerable interest was with GW3YWU/A, in his car at Fishguard, running some 80 watts into a G-whip aerial. More like it on 14 MHz, where the QSO's ranged from a short-skip effort with EI5DH as the band was dying out, through to East-Coast W stations. 21 MHz seemed to be all North America being, as George puts it, "sucked into contests." On Ten there was an unpleasant surprise awaiting, in the form of a T8 report; but some four hours later the fault in the PA stage has been found and rectified, proven by way of a QSO with WØUBT. There were other W's to be noted in the log on this band, too, although on balance it looks as though George prefers 21 MHz for DX. On a different tack, the G3CED reporting system is by copying-off the log pages in the office copier, and it is of interest to note the numbers of stations behind the Iron Curtain who have begun to acquire and use commercial gear, most of JA origin.

G4CVE writes to let us know about the Isle of Man Millenium, for which the Isle has to have a new prefix. Liverpool and District club are mounting a DX-pedition to give the GT prefix a bit of exercise; note down that it is from 2300z June 29 through to the same hour on July 8, Top Band through to 70cm. Of interest to us are the frequencies to search which will be: CW, 1820-1835, 3505, 7005, 14080, 21080, 28080 kHz, while the SSB will be 1820-1835 kHz Top Band (we hope they see sense over that choice before the day lest they all be lynched!), 3695-3780, 7092, 14195-14275, 21245-21275, 28495-28550 kHz. QSL to the Bureau to G3AHD, or direct with IRC's to G. H. Cohen, G4GHS, 41 South Station Road, Gateacre, Liverpool, Merseyside L25 3QE.

Our next letter is one of the rare ones with a bit of 3·5 MHz Phone DX, and doubly welcome since it came from G3TKN (Waterlooville) who now runs an FT-101EE plus KW-1000 linear on the band, to a 55ft. vertical which is resonated by a coil and loaded by way of a toroidal transformer. The whole shooting-match is sitting on a patch of land which was once marshland, and so

the grounding of the vertical is excellent. Recent QSO's on the band included WB2FZO, VO1FG, VE6BGU/SU on the Suez Canal, WA8MOA, WA4TJI, K5MK, VE7BTV, VE4SW, WØMJ, N6HZ, N6DX, W6KUP, K7UU, VE7CMK, VE7XI, W1ZY, N9WB, all going to show the vertical is doing its work. However, as with all things, there is a snag and in this case it is the picking-up of local QRN. To get round this there are two alternative receiving aerials, one a loop with three-foot sides using three turns, resonated, and coupled by a one-turn link which is very effective and has even been used indoors; the other is a bent mini-beverage about 5 feet high and terminated, which although it can hardly be expected to work as a true Beverage certainly does reduce the static on some QSO's. As to why G3TKN is doubly welcome, Vince used years ago to be a regular reporter before he caught the VHF disease!

G2BJY (Walsall) was one of the many who wrote in and didn't get any answer during January—by now it should have become pretty well-known why; if we had answered all those letters, we would still not be back! Seriously, to Geoff and all the others our thanks for their good wishes during this period. Geoff spent his 1978 on Ten CW; this made him a year of 85 countries worked on 50 watts and an end-fed wire—one supposes that in the 28 MHz context it qualified as a long wire. Home constructors may like to take note that Geoff has a direct-conversion receiver working on Forty using *valves* and with warm-up drift more or less finished by the time it has been on five minutes. The first fortnight of January yielded KV4CI, PY2DEH, UH8HAI, UH8HCE, UKØAAC, UL7CBR, UL7RAE, UO5WB, VE4AEX, lots of funny U.S.A. prefixes, ZF2CI and ZO5NW.

Which brings us to a point of some interest. There has for some time been no requirements in the States for signing when out portable, and with the present proliferation of callsigns it has become more or less chaotic; it can't be saving their authorities any money, but it most certainly does make life difficult for the rest of the world. Their new prefixes, which after all were supposed to be status symbols, have become a worldwide joke—the users of them lose face more than the Chinese do by not allowing any amateur radio at all. Let us hope for some action to clear up the mess over there.

Just after last month's piece went down, we got a note from G3NOF (Yeovil) who was back on the bands after a two-months layoff. On Ten, Don noted plenty of openings to the U.S.A., but few good enough to get right over to W6. On 21 MHz things have been more or less the same, but with the band staying open a couple of hours longer in the evenings; on this band QSO's were made on SSB with HI8XDJ, JE3SRS, JE3UHD, JF1JIT, JK1KMG, JR6RAY (Okinawa), K6's, K7FSN (Nevada), K8RAM/AM over the S. Atlantic, N6's, W6's, W7DND (Washington), W7KSA (Oregon), WA5FBH/6Y5, WA6's, WA7IHN (Oregon), WA7TYW likewise, WBØWFE, VK4AJD, VK5CO, TR8GCD, YN1MAT, ZL2CE, ZL3US, ZS1CZ, 7X5AB, and 9L1WS, and lots of the common-or-garden W's. Looking at 14 MHz, the band has been late opening up, not a lot being heard before 0830z, when good signals from VK/ZL have been noted. Band closure has usually been around 2000, but on the odd occasion W6-W7 have popped up around 2330, and ZL's coming in over the South pole around 1830. SSB again, and to CT2BB, EP2MT, KL7JHD, VE7ABJ, W6's, WA7TIB (Washington), WA7YTW in Oregon, VP2VBK and some ZL's. The reason for the QRT was the old bogey of TVI—someone complained that he heard Don at times when he was not even on the air, despite both the Rank service engineer and the Post Office finding him completely clear! Imagination is a wonderful thing!

Another wanderer returned from VHF is G4EAN (Nottingham) who has returned to 21 and 28 MHz. The former saw contacts with OK2BQL AF2C and UA3ACD; the latter lots of Europeans and an equal number of assorted W's. However, his main point is one of some interest to the relatively new operators, and that is the QSO with UA3ACD; they changed bands from 21 to 28 MHz and the signal both ways went up a couple of S-points despite a falling-off in power at the higher frequency.

A full-blown five-band report from G2HKU (Sheppey) this time despite (or, perhaps because of ?) the heavy weather and damage which flooded quite an area; Sheerness well under, the road cut for some hours and the outlying villages without phones or electricity or road links. Taking it from the Top downwards, we find Top Band SSB to PAØKJF, PAØINA, PAØPN and PAØMRN, and CW covering OL9CJH, OK1DWC, HB9NL, PAØINA, GM3PFQ and PA3ADJ. Up to 3·5 MHz, and here a couple of oddball calls in EU2ABC and IN3BRM were raised on CW—both genuine—plus some QRP with the HW-8, to HA9RU, DL6KB, YO3RF, DM2GIL and PA3ADJ.

'CDXN' deadlines for the next three months—

(*April issue—March 1st*)
May issue—April 5th
June issue—May 3rd
July issue—June 7th

Please be sure to note these dates.

Up again, this time to 14 MHz, for the morning SSB sked QSO's, with ZL1VN, ZL1QQ, ZL3RS, ZL3SE and ZL3FV. CW accounted for some others such as C5AAO, VK2QL, UAØAB, JA4OQH, KV4AA, K4FU and UA9WCQ. 21 MHz saw CW—QRO to W9KNI and QRP to WA2ORU, while Ten gave CW to W4DR and K6ZM.

Still on his Top Band and Eighty kick, G4AEJ sends us the final count for the Ladder—the only one to bother. All modes were used, AM, SSB and CW; and on 80 there was a surprise in the form of OY1R at 599.

Awards

We have had passed to us details of the ZB2BU Award, for working that station on three bands, any mode including *Oscar* after January 13, 1978. Applicants should enclose a copy of the log, showing date, time and frequency, and send to Gibraltar A.R.S., P.O. Box 292, Gibraltar—not forgetting three American dollars, or equivalent currency. In the covering letter, ZB2BL says the gang will also be making available an award on the

basis of working any five different ZB2 stations, any band, any mode, from the same date.

Up CW!

We hear from G8PG (Greasby) that the CW operators of Europe, through such clubs as SM CW Activity Group, DLAGCW, our own G-QRP club, and the TOPS CW club are banding together to encourage CW activity, both on the air and by training; membership is open to any club or society if they are actively investigating or organising such training. Membership is not open to individuals. As said, any group can join, the one proviso being that they must be prepared to appoint a "communications manager" to act as their representative, and bear his postage and clerical costs. The EUCW also stress that they are in no way anti-telephony. Details from Sven Milander, SMØIX, Mjolvagen 52, S161 71, Bromma, Sweden.

Still on the same tack, it does seem that the CW merchants over the years have always been able to band together to do what they can to maintain and improve operating standards, and it occurs to this old grey-beard that something similar to FOC but aimed at the Phone operators would be a very fine thing to set up, always given that such a club would *not* be anti-CW and that the entry standards are maintained at a high enough level of operating competence. The writer would happily join such a group, and these pages are open to any thoughts on the subject—but in the long term any group so formed must remain independent and viable without any support from us. Any suggestions?

Attractions

By which means forthcoming DX Activities and whatever. Somalia is likely to be on and around a while, as 601FG goes about the country carrying out his task and operating in what spare time he has. QSL this time to IØDUD, Giuseppe D'Aurelio, Via Antonia Fogazzaro 87, 00137 Roma, Italy. Identified QRM-ers, gasbags, and those asking what he had for breakfast will not be encouraged!

At the time of writing the Bouvet expedition is to be heard, the schedule being 2300z for about 90 minutes; look around 14030 for 3Y1VC's CW and, once the initial impetus gets the mob going, look out for some splitting of frequency. As for QSL's, 3Y1VC goes to LA1VC.

Another one who tends to appear at horrible times is LU3ZY on South Sandwich; look for LU2AFH taking a list around 14220 kHz.

VR6TC's long stint there on Pitcairn Is. will be eased around April 19, when the *Yankee Trader* arrives and off-loads KOBJ, K5UC and N1DX, the first-named being already allocated VR6BJ, but the other two as yet unknown. The ship taking them there will be, clearly, the key to the time the gang will be there; if she goes off to Henderson Is. for wood, then the run may be three or four days. Prior to this, they hope to fire up on Easter Is., CEO, and after Pitcairn come stops at 3D2, KH8 and 8Q6, with several others in between.

Spratly was one of those places which should never have been given country status; now if you want to operate from there, choose between BV, BY, North Vietnam, South Vietnam and the Phillipines, all of whom have claims staked out. Strange how people react to a little oil!

Franz Josef: the gink who was signing from this spot was Phoney Phred again, but the work is being looked into and UK9AAN is indicating the call may turn up as UK1PAA.

On a different tack, the older generation of DX-ers will recall Don Miller, W9WNY, of various DX-peditions and a law-suit against *ARRL* for disallowing some of his operations (which resulted in the present requirements of proof before a DX-pedition is accepted by DXAC). Of late it seems he has been residing in Indio, California, where he was arrested in January for conspiracy to commit murder, arson and insurance fraud.

Many of the younger types will be after YA, that country having been off the air some time. However, the buzz goes out that OZ1CRH, Mazood Khan, will be in AP-land with all the gear about the time this piece comes to be read, possibly signing AP2LJ; and cautious optimism is being expressed that he will manage to get some time in at YA.

The promised Laccadives operation was a busted flush, the Bangalore club authorisation being cancelled by New Delhi after they had set off; so they were not able to land and had to go straight back, and at the moment the indications are that Laccadives Is. won't appear in the near future, although efforts are being made to undo the hang-up.

The Venezuelan Radio Club, once again signing YVØAA, are intending to operate from Aves. The date for which they are aiming seems to be the middle of April (7-14) but dependent to a large degree on transportation by the Venezuelan Navy; operation is scheduled for CW and SSB on 1·8 MHz to 144 MHz.

Contests

The Big Ones come out to play in March; we see ARRL Phone for March 3-4, and the CW leg March 17-18, both with times and rules as in previous years. The exchange is RS(T) plus State or Province in W/VE, with DX—that's us!—dishing out RS(T) plus a three-digit number giving power input.

CQ's WW WPX Contest comes in on March 24-25 for the SSB affair, and May 26-27 are slotted for the CW leg, which is an all-new contest. Essentially it is the mixture as before, for SSB, and a transfer of the same rules for CW affair.

And a contest for the single-handers who like a marathon. KV4AA last year ended up 1978 with some 48,100 QSO's, or one QSO every 11 minutes. W1WY is sending the statistic to the *Guiness Book of Records*, in the hope that it might start them into an Amateur Radio section. So—try and beat that, if you can!

Finale

Here we are again at the bottom of the pile, What we need now is for all the regulars and the new boys to tell us all about their doings—dates in the 'box', and send 'em to your scribe, "CDXN," SHORT WAVE MAGAZINE, 34 High Street, Welwyn, Herts. AL6 9EQ, to arrive not later than those dates. Don't forget, DX is a relative term; the first-ever QSO, be it only just down the road, is the biggest DX of all!

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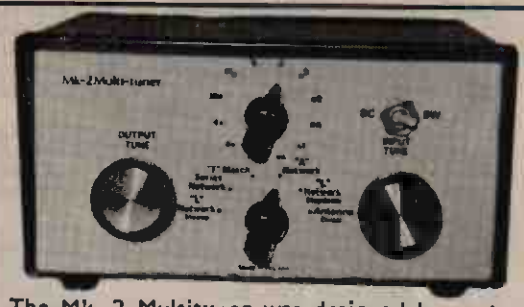

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(GIRO A/C. No. 547 6151)

Printed by The Courier Printing Co. Ltd., Tunbridge Wells for the Proprietors and Publishers, The Short Wave Magazine Ltd., 34 High Street, Welwyn, Herts., AL6 9EQ. The *Short Wave Magazine* is obtainable abroad through the following: Continental Publishers & Distributors, Ltd., William Dawson & Son Ltd.; AUSTRALIA AND NEW ZEALAND — Gordon & Gotch, Ltd.; AMERICA—International News Company, 131 Varick Street, NEW YORK. Registered for transmission to Canada by Magazine Post. *March 1979*