FEBRUARY 1985 99p

Amateur RADIO

For all two-way radio enthusiasts

10m mobile operation

Multi-band grounded aerials

Justice/injustice: you & 'the boys in blue'

On test: Icom IC471H 70cm base station

BACK TO BASICS: PASS THE RAE

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Thorn 10Ω 20W (3500) R751 Safety Resistor	75p
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Pye 713 Complete Tube Base Panel with Focus Slider & Leads	2.75
Pye 713 Control Knobs	4 for 50p
Tube Base Socket ITT CVC32	45p
Tube Base Socket Thorn 3000/8000 etc	50p
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Large IC Extractor	50p
Crystal 4.43MHz	65p
EHT Lead & Cap for Split Diode Lopt	90p
Anode Cap	47p
Sanyo Anode Cap Assy + Lead. 12TCD-CT-1G	65p
Degause Thermistors. PT37P. ITT/GEC	35p
Degause VDR E299D/HP230 3000/8000	25p
Casters Set of 4	1.90
Double Fuse Holder on Small Pax Board 20mm type	10p
Single Fuse Holder on Small Pax Board 20mm type	5p
Direct Panel Mounting 20mm Fuse Clips	(pair) 15p
Single Fuse Holder on Small Pax Board. As per early 3000 mains input	6p
EHT Cable	Metre 25p
13A Plugs	12 for 4.80
BF259 with Heatsink	14p
TIP110 with Heatsink	40p
L129/130/131 Coil	10p
6MHz Ceramic Filter	25p
DL700 (Philips) Chroma Delay Line	1.00
DL50 Chroma Delay Line	1.00
T9006A Lum Delay Line	1.00
8K5/9K Lum. Delay Line	65p
Plastic Cover for 3K5 SP8385	5p
TX9 Back Ground Control 10K	15p
TX9 Gain Control 100R	15p
1500 Metal Chassis Supports Pair	40p
Thorn 8K5 Focus Pot	2.40
Thorn 4000 Focus Pot	2.75
Thorn 18Ω 9W (3K5) R752	30p

SERVICE AIDS

Ambersil MS4 Silicone Grease	12oz	2.15
Ambersil Freezer	12oz	1.99
Ambersil Amberlube	6oz	1.89
Ambersil Ambertron	16oz	1.95
Ambersil Anti-Static Screen Cleaner	7oz	1.95
Ambersil 40+ Protective Lubricant	14.1oz	2.15
Ambersil Amberclens Foaming Cleaner	13oz	1.26
Ambersil Circuit Lacquer	14oz	2.15

THICK FILM RESISTOR UNITS

3500 Thorn (5 Pin Connection) video	1.70
4000 Thorn (4 Pin Connection)	1.90
725/731 Pye (6 Pin Connection)	2.20
713 Pye (6 Pin Connection)	2.20

FUSES

20mm		1¼"	
50MA	10 for 70p	250MA	10 for 65p
315MA A/S	10 for 50p	750MA	10 for 65p
500MA	10 for 50p	7A	10 for 50p
1A	10 for 50p	10A	10 for 50p
2.5A	10 for 1.00	20A	10 for 50p
3.15A	10 for 1.00	50A	10 for 50p

Thorn Mains TX 3000/3500	7.50
Thorn Mains TX 8000/8500	10.00
Thorn S.D.P.T 8000/8500	3.50
Thorn Scan TX 3000/3500	6.00
Thorn EHT TX 3000/3500	6.00
Thorn LOPT 9600	12.00
Thorn LOPT 1615	7.25
Thorn LOPT 1590/91	7.25
Thorn LOPT 1690/91	7.25
Thorn LOPT 8000	9.80
Thorn LOPT 8500	9.80
Thorn LOPT TX9	9.85
Pye LOPT 713	10.00
Pye LOPT 725	9.85
Pye LOPT 731	10.18
Philips LOPT G9	8.80
Philips LOPT G11	13.75
GEC LOPT 3113	7.40
Diode Split LOPT AT2076/35	14.75
Sanyo LOPT AM–WM–21	6.75
Sanyo LOPT AM–WM–4	7.30
Philips LOPT G8	7.80
Sanyo LOPT (CW21) 4-2751-44700	5.00
ITT LDPT CVC5-9	9.60
ITT LDPT CVC30	8.75
ITT LDPT CVC45	9.75
Baird 8750	10.25
Baird 8752	10.25
Korting AZ9100	10.25
Korting B92-170	10.25
Korting AZ2101	10.25
Korting AZ2103	10.25
Korting ZTR1001	10.25
Siemens V1155	11.75
Siemens V1823	11.75
Zanussi BS2222	10.25
Zanussi BS2223	10.25
Salora FR0057	10.25
Salora FR0029	10.25

300 Mixed Resistors	1.50	10 Spark Gaps	1.00
300 Mixed Capacitors	1.50	10–16 pin Quil IC Socket	90p
150 Mixed Electrolytics	2.00	20 Assorted TV Knobs	1.00
100 W/W Resistors	1.00	10–16 pin Quil to Dil IC Socket	90p
20 Mixed Conv Pots	1.00	100 Mixed Diodes	1.00
40 Mixed Pots	1.50	50 Mixed Mica Washers	65p
20 Mixed Sliders	1.00	300 Mixed Resistors & Capacitors	1.50
40 Mixed Presets	60p	10–16 pin Dil to Dil IC Socket	1.00
20 Mixed VDR & Thermistors	1.00	50 Electrolytics & 50 Capacitors	1.00
20 Mixed Ferrite Cores	50p	50 Mixed Poly Capacitors	1.00
100 Mixed Ceramic Discs	1.00	30 Mixed Neons & Bulbs	1.00
20 Mixed Valve Bases	1.00		

						BF167	24	BFR62	28	NKT276	20
						BF173	29	BFR81	29	NKT453	1.65
AC128	39	BC172	9	BC559	8	BF179	32	BFR87	25	DT112	1.92
AC131	40	BC174B	23	BC595	8	BF180	33	BFR90	1.74	DT121	2.08
AC138	40	BC177	24	BCX33	22	BF181	30	BFR91	2.08	R1038	80
AC141K	39	BC182LB	12	BCX34	11	BF184	30	BFT42	30	R1039	80
AC142K	38	BC183L	12	BD115	49	BF185	30	BFT43	30	R2008B	1.40
AC153	39	BC184L	13	BD131	30	BF194	16	BFX38	40	R2010B	1.10
AC176	33	BC187	24	BD132	46	BF195	16	BFY50	30	R2030	70
AC176K/		BC204	15	BD133	59	BF196	16	BFY51	34	R2265	1.30
AC128K	93	BC208	9	BD139	36	BF197	15	BFY52	34	R2305	80
AC188	38	BC212L	9	BD140	38	BF198	19	BRC116	1.50	R2322	50
AD142	1.18	BC213L	12	BD144	1.70	BF199	15	BRC1693	1.43	R2443	25
AD143	1.08	BC237	12	BD150	50	BF223	18	BU105	1.00	RCA16446	30
AD149	90	BC238B	8	BD163	98	BF224	19	BU126	1.10	RCA16599	1.25
AD161	32	BC238L	8	BD201	74	BF238	20	BU207	1.05	RCA16600	1.40
AD162	32	BC250A	15	BD203	78	BF240	9	BU208	1.15	RCA16799	1.13
AD263	1.05	BC251	8	BD204	99	BF241	21	BU208A	1.15	RCA16800	1.42
AF127	45	BC252A	20	BD222	48	BF255	10	BU326A	1.30	RCA16802	1.38
AF139	38	BC294	37	BD225	52	BF256S	20	BU407	1.70	S1299	2.25
AF239	41	BC301	32	BD232	50	BF257	28	BU408	2.76	S28000	1.25
BC107	15	BC303	31	BD233	60	BF259	28	BU500	2.30	S6080A/B	3.50
BC108	15	BC307	10	BD234	60	BF271	25	BU526	2.46	T6050V	1.30
BC109	15	BC308	8	BD237	55	BF274	11	BU807	2.94	T6052V	1.30
BC115	16	BC309	14	BD238	65	BF337	29	C1129	9	T9003V	1.25
BC117	21	BC327	18	BD241	59	BF338	34	C1172B	9	T9010V	1.45
BC125	26	BC328	18	BD244	85	BF355	40	E5386	54	T9053V	1.30
BC126	23	BC337	17	BD278A	81	BF362	50	E9003	28	T9054V	1.00
BC139	27	BC338	17	BD386	68	BF391	21	E9005	25	T9039V	1.10
BC141	34	BC347	8	BD433	71	BF394	16	ME0404	10	TIC45X	50
BC142	30	BC394	8	BD437	83	BF422	47	ME0412	10	TIC46	48
BC143	31	BC454	8	BD592	1.20	BF423	53	ME6002	10	TIC106C	40
BC147	12	BC455	8	BD589	1.20	BF450	43	MJ2501	2.36	TIP29	42
BC148	12	BC456	10	BD677G	1.35	BF453	53	MJ3001	2.21	TIP30	42
BC149	12	BC460	40	BD707	95	BF458	37	MJE182	47	TIP31	35
BC153	16	BC463	22	BD708	95	BF459	40	MJE340	50	TIP32	43
BC1540R	16	BC546	8	BDX10	93	BF461	59	MJE520	50	TIP33	61
BC154YL	16	BC547	12	BDY20	1.09	BF556B	35	MJE2955	1.40	TIP41	42
BC157	12	BC548	12	BDY82	99	BF596	15	MJE3055	1.50	TIP42	45
BC158	12	BC549	8	BF137	20	BF694	16	NKT241W	8	TIP110	61
BC159	15	BC557	10	BF153	20	BF757	62	NKT241G	8	TIS91	25
BC171	9	BC558	10	BF154	25	BFR52	31	NKT241Y	8	ZTX550	30

INTEGRATED CIRCUITS

				TBA530	1.26	TDA2002	2.80
BRC1330	1.40	SN76013ND	1.80	TBA540	1.00	TDA2030	2.10
BRC3064	1.00	SN76023N	1.80	TBA550Q	1.82	TDA2522	2.10
BRC/M/200	1.00	SN76033N	2.00	TBA560C	1.50	TDA2530	2.61
BRC/M/300	1.00	SN76115	2.00	TBA641	2.05	TDA2540	3.50
CA3060	1.58	SN76131N	1.58	TBA651	2.50	TDA2560	3.50
LM1303P	1.40	SN76226N	1.25	TBA720A	2.49	TDA2581	3.00
ML231B	2.20	SN76227N	1.00	TBA750	2.20	TDA2591	1.96
ML237B	2.00	SN76530P	1.30	TBA800	1.62	TDA2611A	1.95
ML239B	2.86	SN76622N	1.30	TBA810S	1.00	TDA2640	2.90
MC1327AP	1.25	SN76660N	80p	TBA810AS	1.00	TDA2690A	1.50
MC1358P	1.30	SN76666N	75p	TBA920	2.08	TDA3560	6.00
MC1455P	18p	SN76744	1.92	TBA950	1.95	TDA9503	2.90
MC14516BCP	60p	TA7117P	1.00	TBA1440	1.92	TCEP100	3.48
SAA1025	7.20	TA7109AP	2.80	TCA270SA	1.05	TEA1009	1.95
SAA1124	4.50	TAA611	1.40	TCA270C	1.05	MC14426P	4.80
SAA5010	6.00	TBA120B	1.20	TCA270CQ	1.05	MC14429P	4.50
SL432A	1.80	TBA120C	1.20	TDA1004A	4.00	MC14514	5.00
SL1430	2.50	TBA120CQ	70p	TDA1035T	3.50	UA758PC	2.50
SN15846N	60p	TBA120S	70p	TDA1037	2.72	UA1008A	2.66
SN74123N	65p	TBA120U	1.00	TDA11705	1.50	ULN2165	1.30
SN74154N	1.40	TBA395	1.00	TDA1200	2.42	ULN2216A	1.25
SN76001N	1.40	TBA480Q	1.40	TDA1270	2.76	UPC1365C	5.75
SN76110N	1.14	TBA510	1.90	TDA1327	2.53	SC9488P	1.40
						SC9511P	1.40
						SW153	2.50

Thorn 8/8K5 ex equip panels untested

PSU	2.88
FTB	3.75
Decoder	4.00

Thorn 9K ex equip panels untested

PSU	12.00
Decoder	5.00

Thorn 9K6 ex equip panel untested

Decoder	5.75

Thorn 3/3K5 ex equip panels untested

PSU	3.75
LTB	3.75
Video	2.50
Chroma	2.00
FTB	2.75
IF	1.75
Conv. 3K	3.00
Conv. 3K5	3.75
Autovox Decoder FG/01 new boxed	5.00
Thorn 4000 Convergence panel ex-factory	3.75

Thorn 4000 PSU panel ex-factory	2.50
Thorn 3K5 beam limiter board new	1.75
Thorn 3K5 PSU bottom board PC206 new	2.75
Thorn 3K5 IF panel new	3.00
Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip	1.80
Thorn 8/8K5 damaged FTB for spares	1.25
Thorn 8/8K5 damaged decoder for spares	2.25

UHF TV Aerial for portable	50p
Indoor Aerial Parabolic Type Reflector to Help Combat Ghosting Problems	2.50
Line Connectors	38p
Coax Plugs	10 for 1.65
Band Change Switch Assy, Pye 725	40p
Flush Mounting TV/FM Diplexer	1.00
Switched Flush Fitting Aerial Outlet	1.00

Pye 78+161	50p
Pye 147+260	50p
Thorn 56+1K+47+12	1.24
Thorn 50+40+1K5	60p
Thorn 128+16+1K7+116+462+126	50p
Thorn 120+72+300	50p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p
Philips 2R2+682	90p
Philips 47R	52p
Thorn 350+20+148+1K5+317	1.40
Thorn 6+1+100	92p
Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	3.50
Thorn 8500	6.00
Thorn 9000	7.90
Thorn 9600	6.00
Thorn 900/950	1.50
Pye 713 5 lead	5.97
Pye 725	6.35
Decca Bradford	5.00
Baird 8750	7.10
Korting AZ9100	7.10
Philips G8 (520)	6.50
Philips G8 (550)	6.50
Universal	5.00

MULTISECTION CAPACITORS

100+150+150	350V	50p
220+47	350V	65p
200+150+50	350V	60p
200+200+100	325V	54p
32+32+16	275V	52p
200+200+100+32	350V	70p
100+50+150	350V	58p
400+400	200V	72p
32+32+16	350V	52p
200+32+300+100	350V	70p
225+25	350V	50p
200+200+100	350V	70p
200+100	325V	65p
200+100+100+50	350V	60p
200+200+100	350V	55p
200+200+75+25	350V	60p
50+50+8	300V	55p
100+50+100	350V	55p
100+150+50	350V	55p
2500+2500 (Thorn 8K)	63V	1.20
150+150+100	300V	1.80
200+47	250V	65p
500+500 175V Thorn TX9		1.00
175+100+100 350V Thorn 3K5		2.25
400 400V Thorn 9K		2.50
470 250V Philips G11		1.50

CAN TYPES

0.2MF 250V	50p
2MF 250V	50p
22MF 275V	50p
50MF 275V	50p
100MF 150V	65p
100MF 250V	70p
100MF 450V	75p
220MF 400V Thorn 9K	1.30
220MF 450V Thorn 4K	1.30
400MF 350V Thorn 8K	1.00
800MF 250V Print type	80p
800MF 250V	70p
1250MF 40V	50p
1250MF 50V	50p
1500MF 70V Thorn 3K	1.00
1500MF 100V	1.05
2000MF 30V	50p
2200MF 40V Thorn 4K	95p
2200MF 63V Philips G9	1.25
2500MF 35V	65p
2500MF 40V	65p
3000MF 30V	65p
3300MF 16V	50p
3300MF 25V	60p
4700MF 16V	72p
4700MF 40V	75p

Thorn/Decca/GEC On/Off Switch. Push to make	75p
Philips G11 On/Off Switch. Push to make	75p
ITT CVC8 On/Off Switch	65p
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	75p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 50Ω	65p
2·5A Push to make on/off switch	15p

DIODES

AA112	8p	IN4003	4p
AA119	8p	IN4004	5p
AA143	8p	IN4005	5p
BA115	8p	IN4006	5p
BA154	8p	IN4007	6p
BB103	8p	IN4148	2p
BB105B	30	IN4149	6p
BR103	52p	IN4742A	8p
BR303	46p	IN5254B	8p
BT106	1.50	IN5349	14p
BT116	1.00	IN5400	12p
BT119	2.56	IN5401	12p
BT120	2.82	IN5402	14p
BT151 650	1.00	IN5404	12p
BY127	12p	IN5406	16p
BY188	16p	IN5408	16p
BY204	26p	IS025	8p
BY206	16p	IS131	8p
BY207	16p	IS1658	8p
BY208/800	38p	MR854	35p
BY223	95p	SKE1/02	20p
BY225	1.20	MCR106/1	1.00
BY227	28p	MCR406	35p
BY298	22p	2N4444	1.50
BYX22/400	30p	Y827	80p
BYX55/600	30p	Y969	75p
BYX71/350	80p	ZX150	12p
BZV15 C12R	1.16	DA91	5p
BZV15 C24R	1.16	MCR106/7	1.00
IN60	8p	MCR106/8	1.50
IN2070	8p	TD3F800H	2.80
IN4001	4p	TD3F800R	3.00
IN4002	4p	BY255	30p

Amateur RADIO

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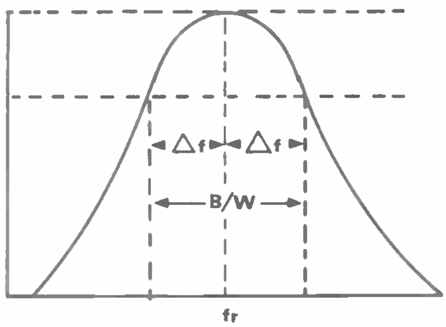


SERVICES

LOWE SHOPS

Whenever you enter a LOWE ELECTRONICS' shop, be it Glasgow, Darlington, Cambridge, Cardiff, London or here at Matlock, then you can be certain that, along with a courteous welcome, you will receive straightforward advice. Advice given, not with the intention of 'making' a sale, but the sort which is given freely by one radio amateur to another. Of course, if you decide to purchase then you have the knowledge that LOWE ELECTRONICS are the company that set the standard for amateur radio shops and after-sales service. The shops are open Tuesday to Friday from 9.00 to 5.30 pm, Saturday from 9.00 to 5.00 pm except Glasgow, which on Tuesdays opens at 10.00 am. For lunchtime closing arrangements, please check with the individual shop.

In Glasgow the LOWE ELECTRONICS' shop (the telephone number is 041 945 2626) is managed by Sim GM3SAN. Its address is 4/5 Queen Margaret's Road, off Queen Margaret's Drive. That's the right turn off Great Western Road at the Botanical Gardens' traffic lights. Street parking is available outside the shop and afterwards the Botanical Gardens are well worth a visit.

In the North East the LOWE ELECTRONICS' shop is found in the delightful market town of Darlington (the telephone number is 0325 486121) and is managed by Don G3GEA. The shop's address is 56 North Road, Darlington. That is on the A167 Durham road out of town. A huge free car park across the road, a large supermarket and bistro restaurant combine to make a visit to Darlington a pleasure for the whole family.

Cambridge, not only a University town but the location of a LOWE ELECTRONICS' shop managed by Tony G4NBS. The address is 162 High Street, Chesterton, Cambridge (the telephone number is 0223 311230). From the A45 just to the north of Cambridge turn off into the town on the A1309, past the science park and turn left at the first roundabout, signposted Chesterton. After passing a children's playground on your left turn left again (between the shops) into Green End Road. Very quickly, and without you noticing it, Green End Road becomes High Street. Easy and free street parking is available outside the shop.

For South Wales, the LOWE ELECTRONICS' shop is located in Cardiff. Managed by Richard GW4NAD, who hails from Penarth, the shop (the telephone number is 0222 464154) is within the premises (on the first floor) of South Wales Carpets, Clifton Street, Cardiff. Clifton Street is easily found, being a left turn off Newport Road just before the Infirmary. Once in Clifton Street, South Wales Carpets is the modern red brick building at the end of the street on the right hand side. Enter the shop, follow the arrows past the carpets, up the stairs and the 'Emporium' awaits you. Free street parking is available outside the shop.

LOWE ELECTRONICS' London shop is located at 223/225 Field End Road, Eastcote, Middlesex (the telephone number is 01 429 3256). The shop, managed by Andy G4DHQ is easily found, being part of Eastcote tube station buildings and as such being on the Metropolitan and Piccadilly lines (approximately 30 minutes from Baker Street main junction). For the motorist, we are only about 10 minutes' driving time from the M40, A40, North Circular Road (at Hanger Lane) and the new M25 junction at Denham. Immediately behind the shop is a large car park where you can currently park for the day for 20p. There is also free street parking outside the shop.

Although not a shop there is on the South Coast a source of good advice and equipment – John G3JYG. His address is 16 Harvard Road, Ringmer, Lewes, Sussex (telephone 0273 812071). An evening or weekend telephone call will put you in touch with John.

Finally, here in Matlock, David G4KFN is in charge. Located in an area of scenic beauty a visit to the shop can combine amateur radio with an outing for the whole family. May I suggest a meal in one of the town's inexpensive restaurants or a picnic on the hill tops followed by a spell of portable operation.

TRIO TS830S

hf transceiver

The TRIO TS830S is for the operator who wants a dedicated amateur bands only transceiver, who is used to and wants a pair of rugged 6146B valves in the PA stage and who wants a compact rig which has its own in-built power supply. The TS830S is for the radio amateur who requires a rig capable of rising above today's crowded band conditions, a rig that has, as standard, the necessary features that will produce consistently good contacts where other lesser equipment would fail. The TRIO TS830S, a proven rig with an impeccable pedigree.

The TS830S covers on USB, LSB and CW the full amateur bands from 160 through to 10 metres.

Convenient to use, the transceiver has its own in-built power supply.

VBT (variable bandwidth tuning) enables the operator to, at will, vary the IF filter passband width and establish optimum IF bandwidth relative to the interference being experienced.

The IF shift control allows the IF passband to be moved up or down in frequency without having to retune the receiver. Hence, an unwanted signal, present in the IF passband, may be attenuated significantly by moving the passband in the appropriate direction.

As the IF shift and VBT are independently adjustable they can, to advantage, be used together.

The tunable notch filter in the TS830S is a high-Q active circuit in the 455KHz second IF. Sharp, deep notch characteristics will eliminate a strong interfering carrier within the passband of the receiver section.

The RF speech processor in the TS830S provides added audio punch and increases the average SSB output power whilst suppressing sideband splatter. Compression levels can be monitored and controlled from the front panel.

To cope with pulse type (such as ignition) noise, the transceiver has an in-built noise blanker.

For perfect listening, a tone control adjusts receiver audio frequency response to suit operating conditions.

Both RIT and XIT, transmitter as well as receiver incremental tuning are included to aid operating, XIT being a distinct advantage when calling a station that is listening 'off frequency'.

It is possible to monitor the transmitted audio in order to assess the effects of the speech processor: a most useful feature ensuring perfect signal reports.

TS830S amateur band transceiver............£793.10 inc VAT, carr £7.00

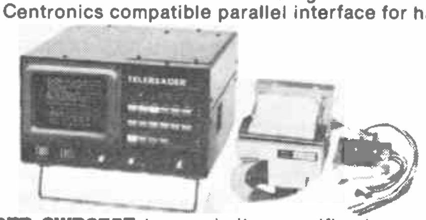
LOWE ELECTRONICS

Chesterfield Road, Matlock, Derbyshire. DE4 5LE.
Telephone 0629 2817, 2430, 4057, 4995. Telex 377482.

the TELEREADER range

Those of you who have seen TELEREADER products will know that outstanding performance allied with ease of operation are the hallmarks of this particular company. The four models in our range are the CWR685E combined transmitter and receiver, the CWR675E having receive only and built in monitor, the CWR670E being a CWR675E without monitor and the CODE MASTER CWR610E which not only receives CW and RTTY (Baudot and ASCII) but doubles as a morse tutor. TELEREADER also have an AMTOR unit, the AMTOR10A, details for this are available on request.

The CWR685E has many outstanding features . . .
CW, Baudot and ASCII receive and transmit: CW at 3-40wpm, RTTY at 45.45-300 bauds (six speeds).
Built-in 5in green phosphor screen giving a clarity and brightness that I have not seen before.
An external QWERTY keyboard housed in a substantial metal case and supplied with 3 feet of connecting cable. Not a 'rubber key or plastic faced touchpad' but a true keyboard.
6 Memory channels (63 character capacity each). In addition the 4 standard test transmissions (RY, QBF, Baudot all characters, ASCII all characters) are permanently stored in memory and can be recalled and transmitted in a variety of formats. 480 characters of transmitting buffer memory are also included.
Automatic and manual transmit/receive switching.
Printer output: Centronics compatible parallel interface for hard copy.



The TELEREADER CWR675E has a similar specification to the CWR685E having the built-in 5in green monitor but not including the transmit facility. The CWR675E provides for both the enthusiastic radio amateur and short wave listener access to both the amateur and commercial world of RTTY as well as providing a visual display of received morse code. The CWR670E is as the CWR675E but does not have the monitor.

The TELEREADER CWR610E Code Master is a compact CW/RTTY converter which also doubles as an audio-visual morse tutor. Features of the CWR610E Code Master are . . .
CW, RTTY (Baudot and ASCII reception).
CW: 3-40wpm, Baudot/ASCII: 45-600 bauds (seven speeds).
CW morse practice at 2-30wpm.
Display characters: 612 characters x 2 pages.
Centronics compatible parallel interface for printer output.
UHF/VIDEO display output.

CWR685E . . . . full receive/transmit .... £771.64 carr £7.00
CWR675E . . . . receive only with monitor .... £449.17 carr £7.00
CWR670E . . . . as above but without monitor .... £392.80 carr £7.00
CWR610E . . . . codemaster .... £195.00 carr £3.00
PK675 . . . . printer for CWR675E .... £189.00 carr £7.00
AMTOR10A . . . amtor unit .... £253.20 carr £3.00
all prices include VAT.

TS430S

The TS430S combines the facilities of a solid state HF transceiver with those of a general coverage receiver. It's the ideal rig for the radio amateur who not only wants to communicate with his fellows but also enjoys listening to the world. As an amateur band transceiver the rig covers top band to ten metres, as a short wave receiver coverage is from 150KHz to 30MHz. Operating on AM, FM, USB, LSB and CW the TS430S is extremely compact and, as such, is the perfect transceiver for mobile, portable or base station operation.
TS430S HF transceiver with general coverage receiver .... £733.55 inc VAT.

TW4000A

Taking into account the amount of activity on the 2 metre FM channels it is not surprising that many people have turned their attention to the wide open spaces of 70 centimetres. With the TW4000A, TRIO have produced a dual band FM transceiver that gives its owner the best of both worlds. Facilities include 10 memories, two VFO's, priority channel, full repeater operation, band scan and memory scan. In memory scan mode the rig can be instructed to look for either 2 metre or 70 centimetre signals. The transceiver produces 25 watt RF output on both bands and comes complete with mobile mount and microphone. For greater safety whilst mobile the optional VS1 board will announce frequency, memory channel and whether or not the rig is set on repeater shift.
TW4000A dual band FM mobile .... £510.97 inc VAT.

R600

For those who are banned from the house and have to operate from the shed at the bottom of the garden, why not consider an R600 to monitor the bands from the comfort of the fireside. No wife would forbid such an attractive looking receiver in the lounge, after all it could also be used to listen to *Women's Hour*. The R600 is a basic receiver covering from 150KHz to 30MHz and having switched upper and lower sidebands, wide and narrow am and cw. It has a 20dB attenuator and a noise blanker fitted as standard. Operation is simple, select the mode of operation, turn the MHz dial to the correct band and, by using the VFO knob, tune to the desired frequency. The clear digital readout makes station selection simple. The TRIO R600, your passport to comfortable listening.
R600 general coverage receiver .... £285.26 inc VAT.

LOWE ELECTRONICS

Chesterfield Road, Matlock, Derbyshire. DE4 5LE.
Telephone 0629 2817, 2430, 4057, 4995. Telex 377482.

L·E·T·T·E·R·S

SPECULATION

I read GW4OXB's comments in the December issue on the *'Dipole of Delight'* and his speculation as to what was in the sealed centre unit.

Whilst I am not certain that I can answer this, it is possible to speculate with some degree of confidence. Early issues of the *ARRL Antenna Book* highlighted the point that the centre of a resonant dipole was at voltage zero and could therefore be earthed. Feeding could then be via balanced line and delta match or coax and gamma match, with a reference to the fact that the ground wave screen gave improved rotary radiation/pick-up properties.

However, a gamma match might result in a rather wide centre unit and it may be that Mr Hateley is using a pair of capacitors at the centre, with the central connection earthed and their value chosen to give an impedance match to the coax.

Just thoughts – I've no idea how near to the truth.

L W Barker G3WAL

NO REPLY

There was a time, not so long ago, when a letter to a radio dealer – any radio dealer – brought forth results within a few days. Sadly, this is no longer the case.

During the past seven weeks I have written to eleven radio dealers – in each case enclosing a stamped envelope. Results to date? Nil!

I wouldn't have minded if they'd been 'nasty' letters, but they were simply asking for information on goods available, or quotations – or in the case of three of them, trying to get some action from one dealer who had welched over a £60 CCTV camera deal! In all, they cost me £3.74 in stamps, and nothing to show for it. It has certainly brought home to me that the amateur radio scene has attracted the attention of a lot of dubious characters who are out to make a 'fast buck', with no strings attached. It would appear that they also collect unused 17p stamps!

My advice to would-be buyers is to deal only with established companies who advertise regularly in the radio magazines and are known to provide a good after sales service. If you *have* to buy from a 'junk' source, make sure it's within reasonable 'car range' before parting with your hard earned cash. This limitation certainly puts a question mark on 'rally buying' – but there again, every enthusiastic 'rallyer' knows the stalls he can trust.

If you *must* deal with an unknown 'junkman' then don't spend a fortune, don't bother to ask his address – examine your purchase carefully, and count your change! It's a bit restrictive I know, but from my experience you'll be in pocket in the long run, in more ways than one!

Nev Kirk G3JDK, Rotherham

'X' OPERATORS

I was most interested to read the article entitled *'Pirates Ahoy'*, in the September issue of ***Amateur Radio.*** Although my own ham experiences do not go back to the 1920/30s, I did start SWLing in 1945/46.

You may be aware that towards the end of 1945 the first amateur bands to be re-released to Gs were 10m and 160m and a little later 5m.

Operation on 20, 40 and 80 metres was not permitted until June 1946 and I can well remember listening on many occasions to stations, particularly on 40 metres, during the period say November 1945 to June 1946 signing X2DY, X2DX, X3JL etc. These are some of the calls that I can remember but there were many more. I can only assume that they were genuine pre-war calls and the operators were very impatient with the authorities for not releasing the aforementioned bands.

I was not a member of the RSGB at the time so I did not have access to the *Bulletin*, but I do know that reference to these operators did appear from time to time in *Short Wave Magazine* around this period. As far as I am aware nothing has ever been mentioned about this spate of illegal operation since then in any of the magazines and I still don't know if in fact, for example, X2DY was G2DY. I should imagine that in any case none of the operators would ever have admitted to being an 'X' operator.

I should explain that the operators to whom I refer were obviously British and I only heard them on AM phone, because at the time I could not read CW although there may have been operation on CW of course.

I would be interested to learn if any other amateurs of that period can recall this particular spate of illegal operation. I would be very surprised if any of these 'X' stations ever issued QSL cards!

M C Pavely G3GWD, Kent

SOLDERING 'TIP'

I read your review on the Oryx soldering tools with interest – but with iron coated tips being the price they are, I feel I must stick my neck out and make one important observation.

I've been out of the electronics game for two years now, but prior to that ran a laboratory in which we had twenty soldering stations (Weller) with irons fitted with iron coated bits.

However, bit life was very short, until it was pointed out that we were using the wrong type (not make) of cored solder. We had been using Ersin 'Savbit' which apparently, due to its chemical composition, really chewed up iron coated bits.

On the recommendation of our suppliers, we switched to Ersin's standard 60/40 lead tin alloy solder, and our bit wastage ceased.

The remaining stocks of Ersin Savbit were used with standard copper coated bits with no ill effects.

H N Kirk, Yorks

GOOD LUCK TO CB

I do not often write letters to magazines, but I feel I should like to respond to the letter from David Harding printed in the December issue of ***Amateur Radio.***

As to the ham fraternity washing their hands of CB, this is just not so. I have several amateur friends who use CB for what it was intended – a means of short range communication.

I agree with Mr Harding that it is very useful for mobile operation and is used extensively as such.

I'm sure that most amateurs do not think that CB is 'negative and defeatist'; they just don't give it a thought. This is not to say however that most amateurs are against CB, most are prepared to 'live and let live' providing they are not blamed for the interference caused by some CBers.

I feel that the reason the authorities tend to ignore CB is the way it was thrust upon them. I also think that the RSGB is not against CB, they probably think as I do in that it is not pure amateur radio, that most CBers do not think as radio amateurs do, and that if a CBer wishes to take up amateur radio as a hobby he will get help from the RSGB and the amateur radio hobby in general.

I have been told by ex-CBers that it was the wallies who drove them away from the hobby. This may be so but I'm sure that any CB operator who tackles the technical side of radio will get a lot more satisfaction than can be obtained from pressing the 'mike' switch and talking.

This is not meant to be a criticism of CB and I hope it will not be taken as such.

Good luck to the CB operators who follow the terms of their licences. We amateurs have nothing against them.

R M Dotchin G3WEP, Bedford

ADVICE NEEDED

I am a home brew enthusiast who wishes to venture into the one side of the hobby that appears not to have been put into print – metal finishing or silver plating components.

Having scoured the technical bookshelves of our local library on the subject and drawn a blank, I wondered whether any of your readers may have any information on metal plating.

Any advice on plating would be much appreciated.

H Cheetham G1DCM, Nottingham

STRAIGHT & LEVEL

All the latest news, comment and developments on the amateur radio scene

SSTV GROWTH

More and more Ws are appearing on 20m SSTV using the new Robot colour system, which have been worked 2 way using either 12, 24, 36 or 72 second single frame colour.

Two of the latest users are WA2FF and N2WA, neighbours in Patterson, NJ, both using Robot's 1200C with Tandy TRS-80 computers for control and graphic generation. They will be able to work both G2BAR and G4UFV who are also equipped with 1200C systems.

Recent short skip on 20m enabled G3WW and GW3WIL to swap Robot 450C colour pictures, while on 2m G2BAR and G3WW have replayed one another's replays in colour.

Volker Wrasse's (DL2RZ) various SC model scan converters around Europe continue to give their owners 2 way SSTV QSOs with G3WW in 8, 16 and 32 second frame black and white and 24 and 48 second single frame colour. However, 8 second frame black and white and 3 x 3 or 2 x 2 RGB remain the standard types of SSTV transmissions.

There is a possibility that SSTV may be transmitted from the April 51-H space shuttle flight of Tony England W0ORE. In the USA considerable concern has been expressed over the picture mode formats to be used! Perhaps here however the RSGB can reserve the UK 2m SSTVers at least a QRM-free frequency?

STEP-BY-STEP

Computer users require a more than powerful memory and a fast printer to get maximum production from their machines. They also need to be proficient at typing, getting information and instructions into the computer quickly and efficiently. Barron's new self-instruction book, *Step-by-Step Keyboarding on the Personal Computer*, teaches the user to increase typing output and thereby increase computer output.

All typing skills and special computer operations are taught one step at a time, then immediately strengthened through practice exercises and drills.

Topics include word processing techniques, preparation of all types of business correspondence, editing and proof reading a text, and other essential skills. Numerous business applications are included, making the book particularly useful for upgrading office production. A special 'Word Processing Workbook' section contains 25 lessons with abundant instruction, practice and drill material. In addition, the book includes an introduction to the important words and symbols of BASIC.

For further information tel: (01) 734 7282.

MULTI-P6+

ARM are about to launch the Multi-P6+ mobile antenna which promises to be as versatile as a boy scout's pocket knife. This all stainless steel British made aerial should satisfy all the needs of the discerning mobile operator.

Designed primarily for 2m multi-mode working, the P6 is many aerials in one. It will

PANAVISE RANGE

The versatile Panavise range of bench-top tools and equipment has been enhanced by several recent additions, and Greenwood Electronics, the sole UK distributor, claims that it now caters for virtually any application.

The original 301 Panavise assembly comprises the 300 base which can be attached by screws to a bench-top and the 303 vice head which slots into a universal-type joint on the base and can be twisted and tilted to any desired position and then locked in that position by hand tightening a knob. An alternative vacuum base version (model 380) can be secured to any smooth non-porous surface. At least four types of base can be used on the original 301 'vise'.

New developments include the model 324 Electronic Work Centre, which has a model 371 solder and soldering iron holder mounted on the base. An adjustable PCB rack (315) completes this unit.

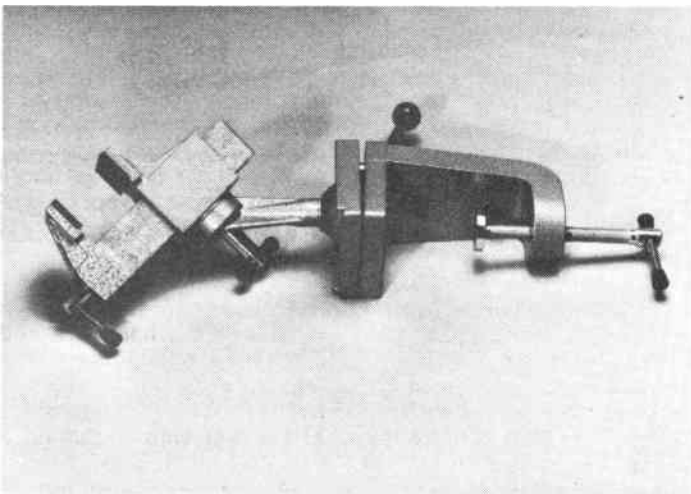
Other items that can be used on all base units are: the model 337 fixture head for production fixturing or the 336 up/down converter base to give additional dimensions of height and tilt. The model 376 with very wide-opening jaws and the model 366 with general purpose jaws fit all base units and offer greater versatility in clamping the work piece.

A novel vice for the electronics workshop, the Oryx 1B has a base which can be clamped to the side of a bench and a lockable ball joint which allows the vice head to be rotated 360° in the horizontal plane and through 90° in the vertical plane. By this means, the vice head can be adjusted easily through a complete hemisphere of positions relative to the base and its jaws can grip objects in any orientation from horizontal to vertical.

Ideally suited for drilling and soldering work, the rubber faced jaws have a 90mm maximum opening and are designed to hold a PCB securely but gently. Moreover, the vice head can easily be detached and replaced by a sponge-backed PCB holder accessory making the Oryx 1B an exceptionally versatile tool for any electronics workshop.

Greenwood Electronics Ltd, Portman Road, Reading, Berks RG3 1NE. Tel: (0734) 595844.

Oryx 1B vice



operate vertical or horizontal, directional or omni-directional. It can be used as a DF loop or, by attaching the extra element, easily converted to a directional horizontal collinear, ideal for hill top DX working. In addition to all this its free space design allows these facilities to be used off the car, indoors or outside.

The tuning stub is continuously adjustable for higher frequencies, including 70cms. Performance in the vertical plane is equal to the popular ⅝ but as you don't have to rely on the vehicle as a ground plane a better all round radiation pattern is claimed.

For further information contact R Whithers Communications, 584 Hagley Road West, Oldbury, Warley, West Midlands. Tel: (021) 421 8201/2.

AMTOR/RTTY FOR THE BLIND

Over the past few weeks three radio amateurs, G4VWW – Steve, G6YYZ – Terry and G6TLI – Phillip decided to pursue a project in which a whole new world could be opened up for blind operators in the use of RTTY/Amtor.

The reason for this idea was mainly due to a friend Steve (G4VWW – IK3CSU) who visits them regularly once or twice a year from Italy.

During his most recent stay he took tremendous interest in the use of RTTY/Amtor, but there was only one problem: he could not operate the system unless there was someone in attendance.

At long last they have managed to overcome this, and decided to let other operators in the same position as Steve know that it can now be done.

The idea was to look at speech synthesis, which basically works on the same lines as a printer (but without the paper!) and also is compatible with most computers, ie RS-232C or Centronics parallel interface.

There were one or two problems to be overcome because the speech synthesiser they used which came from Braid systems had only an RS-232C serial port, and although their particular computer had provision for both, it only sent data to a printer via the Centronics port. So consequently it would not allow them to run Amtor at the same time because the Amtor modem only had RS-232C as well.

Rather than wait for the optional Centronics port to be fitted they decided to overcome this problem by connecting both the Amtor unit and the Braid Synthesiser together.

This was done by using the RS-232C input to the computer from the Amtor unit and in parallel from the data output of the Amtor to the synthesiser.

All control codes to the Amtor unit and the synthesiser are sent by the computer from the RS-232C data out port. This meant putting the Amtor unit into transmit mode and then sending the various control codes to give the functions available (pitch, words or letters), and the data was then confirmed via echo back to the synthesiser.

It must be added that it depends on the particular computer that is in use, the computer that was used in this case being the Tono 9000E communications terminal.

Some computers have different provisions, such as the Apple 2 which can use TTL levels to drive the Amtor unit and RS-232C to send the data to the Braid synthesiser. The same also applies for the Commodore 64.

For further information contact Phillip Stanley G6TLI, 67 Clapham Road, London SW9 OHY.

BARTG NEWS

At the RSGB VHF Convention at Sandown Park on 23 March 1985, Ian Wade G3NRW, of the British Amateur Radio Teleprinter Group (BARTG), is presenting a talk entitled *How Packet Radio Works.*

Aimed at beginners to data communications, Ian first takes a brief look at the problems of RTTY and Amtor which initially prompted the development of packet radio, then moves on to the basic features of the AX25 packet radio protocol. Many practical uses of packet will be described, together with details of the hardware and software needed to run it. The talk is illustrated throughout with slides, tape recordings and visual aids, including a very special piece of string....

The winter 1984 edition of the BARTG magazine *Datacom* is another bumper issue, with 116 pages of technical articles, reviews and news items covering all aspects of data communications, including RTTY, Amtor, packet radio and FAX.

Special features include full circuit and constructional details of the ST5MC terminal unit (TU), suitable both for conventional teleprinters and for home computers. The TU is based on the classic ST5 design, well proven over many years, and especially suited to handling weak RTTY and Amtor signals on HF and VHF. For this design BARTG supplies printed circuit boards and kits for home assembly, plus ready-built and tested units.

Datacom is sent free to BARTG members every quarter. Membership of BARTG has more than doubled during 1984 to just under 2700, and the group has now set a 1985 target of 5000 members.

For full details of membership, contact Mrs Pat Beedie GW6MOJ, 'Ffynnonlas', Salem, Llandeilo, Dyfed, Wales. Tel: (0558) 822286.

CORRECTION

In the December issue an article entitled *Building Loaded Vertical Whips using CAD* incorporated a program which has caused some confusion. Below are listed a few points which may help to explain:

All instances where "I" appears in the copy of the program, it is figure 1 and not the capital letter. All instances where "O" appears it is figure 0 (zero) and not the capital letter.

Some people have had difficulty with LINE 220 due to the misinterpretation of the letters "LN". This is not a variable as possibly thought, but a function for logarithms, as an LN function appears on the ZX81 keyboard. The expression – (LN N/LN 10) in LINE 220 is calculating the natural log of variable N to log with base 10. This has to be done due to the computer dealing with natural logarithms.

The letters "PI" are also a function for π (3.142 etc) and not a variable.

Some queries were made regarding the two assignments of variable L, which appear in LINE 98 and LINE 750. No problems actually occur in practice as the two values do not interact.

The method of utilising a kind of *shorthand* for powers of numbers may confuse some people. On the ZX81, for instance, at LINE 350 "1E12" and "1E6" are used. 1E12 in fact is the same as using 10 to the power of 12, and 1E6 is the same as 10 to the power of 6. The use of this saves space in display and memory.

VERY MUCH ALIVE

We must apologise to Mr Rex Toby G2CDN who was referred to as the late G2CDN in the article entitled *'The pursuit of excellence: G3WW'* in the December issue.

As his callsign had not appeared in the 1983 and 1984 callbooks the author of the article assumed he was a 'silent key'. We are pleased to be able to reprint the following letter from Mr Toby himself, which verifies that he is still very much alive.

'I have just been informed by one of your readers, my good friend Steve Blayer G4UKR, that he was shocked to read in your magazine that I had passed away.

Apparently it was mentioned in an article written by John Heys G3BDQ, another friend of mine, covering the activities of G3WW (also known to me personally for 30 years!).

I happen to be 72 years old, and have just returned from South Africa where I have lived for the past 4 years, having the callsigns ZS2RJ and ZS6XC.

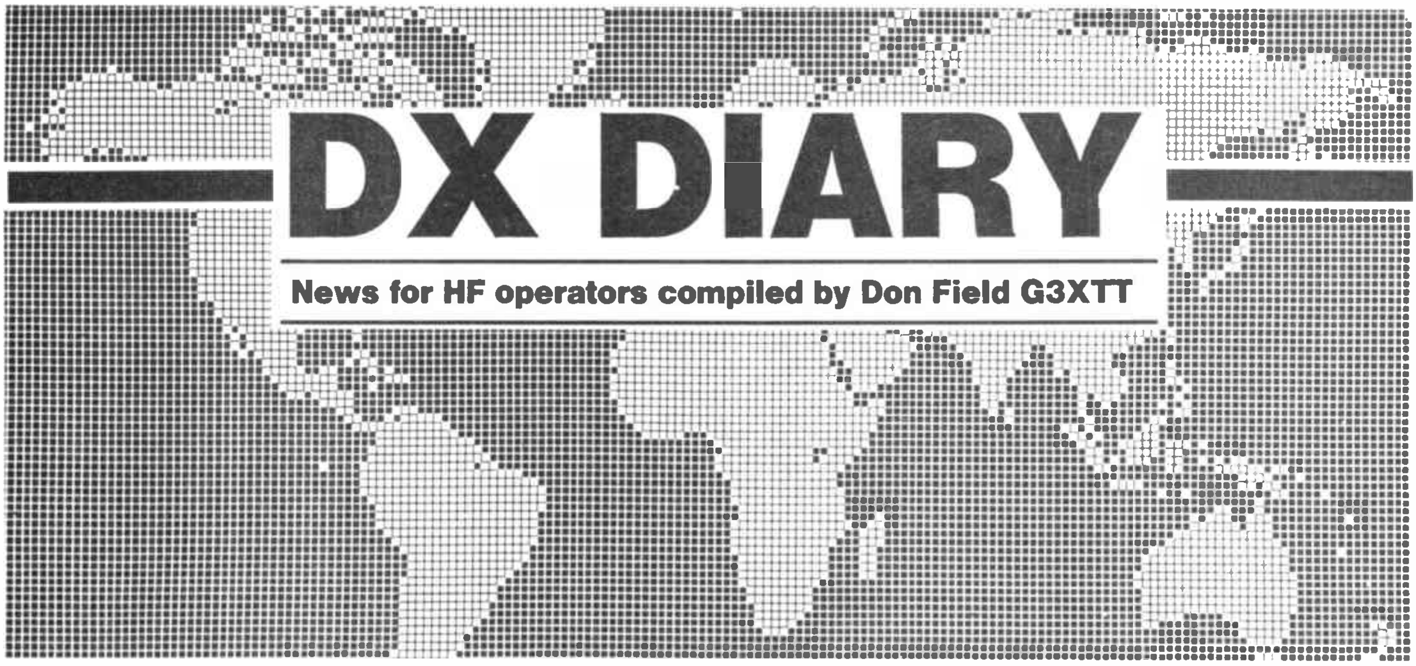
Perhaps you will be kind enough to let my many friends know that at this moment in time, the published information is erroneous! Many thanks in advance'.

RACAL USER GROUP

In the November issue we mentioned the Racal User Group in these pages. Those who wished to obtain further information were advised to contact Mr Peter Barker G8BBZ.

Mr Barker has recently advised us of his change of address, and any enquiries should now be forwarded to him at *15 Epping Green, Woodhall Farm, Hemel Hempstead, Herts HP2 7JP.*

All mail sent to his old address is being passed-on.



DX DIARY

News for HF operators compiled by Don Field G3XTT

A look at the future of the HF bands

With the New Year well and truly under way it may perhaps be a good opportunity to reflect on where HF amateur radio is taking us. When amateurs first started to explore the HF bands they found themselves doing valuable pioneering work and laying trails for the professionals to follow. Those days are past, although amateurs have continued to demonstrate innovation. One of the most striking examples was their adoption of SSB on the HF bands during the 1950s and 1960s, again a path which the professionals have followed at a later date.

Having said all this, there are those in our midst who believe that the only pioneering work now being done by radio amateurs is in the microwave part of the spectrum. Certainly it is true that the professionals are now extremely sophisticated in their use of HF, while on the whole we seek to preserve the status quo which existed as early as 20 years ago. Our contests are based on SSB and CW operations, our techniques are no more efficient in their use of the spectrum than they were then, our ability to raise a specific station other than by prearranged schedule is still largely a matter of chance.

Which way forward?

None of this need be so. Our VHF colleagues are starting to experiment with selective calling and packet radio, techniques which enable a message to be sent in an efficient manner to a predetermined station even when the distant operator is absent or otherwise engaged.

Potentially our HF bands could be used as the 'trunk' element of a worldwide packet-switched data network of which the VHF bands formed the 'local' end, permitting reliable messaging to radio amateurs throughout the world. This would be aided by improved propagation forecasting through the use of computers, just as the weathermen have been able to improve their forecasting as more powerful computers have become available.

Other possibilities

A host of other possibilities present themselves, and most are feasible now. All they require is the will and an element of co-operation in agreeing standards, etc. Maybe this is not what you want out of HF, just as I am sure there were those who resented the passing of AM when the new-fangled SSB took over. Certainly I am sure that simple CW must continue to have a place.

We do not want, with our increasing sophistication, to disenfranchise up-and-coming amateurs in third world countries, or indeed here at home, who for whatever reason cannot afford the latest all-singing all-dancing microprocessor controlled creation. CW will continue to offer a cheap and simple way into the hobby, while at the same time going a very long way to overcoming the barrier of language (will the next generation of rigs include a language translation capability? Us English speaking amateurs tend to forget that amateurs elsewhere have to learn a foreign language when they take up the hobby).

I would be interested to know what sort of scenario for HF amateur radio our readers envisage for the year 2000. Will it be as now, though perhaps with more RTTY given the increasing use of micros by amateurs? Will things have developed along some of the lines I have been discussing? Or will HF be dead in favour of a worldwide VHF network based on geostationary satellites acting as telephone exchanges in the sky? Why not put pen to paper and let me know what you think?

Drew GM3YOR, Steve G4JVG and XYL. Photo G37AY

Operation Raleigh

In the meantime, and at a more down-to-earth level, *DX News Sheet* reports that there may be opportunities for radio amateurs to become involved with Operation Raleigh. Operation Raleigh, for those who don't know, is a round-the-world expedition for young people taking place over a four year period and modelled on a similar exercise, Operation Drake, which took place several years ago. Young people will join the expedition ship for three months at a time to take part in scientific and other activities. If all goes well it will be possible for radio amateurs to be involved when the expedition visits South Georgia in late 1985. The cost of the trip is likely to be around £2,500 per person, though there is no objection to this being raised through sponsorship.

Licensed British amateurs holding Class A licences, preferably under 25 years of age with proven HF operating skills, are invited to apply. Applications should ideally be in by the end of January, but in any case contact G3KMA at his callbook address if you require further information.

Vatican City

Three amateur stations show up from time to time from this small DXCC country. These are HV1CN, HV2VO, and HV3SJ. HV2VO is located outside Rome at the Vatican Observatory (but still on Vatican soil) and the licensee is Father Benedetti who is operational only on SSB. During December, however, some visiting Italian amateurs activated his station on CW on all bands much to the delight of many. A particular feature of the operation was the inclusion of 160 metres (which, I'm delighted to say, gave me my 101st country on the band).

There had been a previous attempt to operate 160 metres from the Vatican from HV3SJ's station at the Vatican proper in the centre of Rome, but this had proved to be impossible due to severe interference from the medium wave transmissions of Vatican Radio. If you worked HV2VO on the weekend of 7-9 December then QSL to I2BBJ.

Pacific News

VK0GC is now back on Macquarie Island and, from experience of his previous spell on the island, I would recommend looking for him in the mornings on 40 metres. Denise VK0YL is also reported to be operational from the island. VK3NM was due to be operational from Norfolk Island from 19-26 January and then from Lord Howe Island from 26 January to 3 February. VK9ZR should by now have replaced VK9ZA on Willis Island. VK9XZ, a new operator on Christmas Island, has been reported working into the USA on 80 and 40 metres and may by now have discovered the higher bands and be working into Europe. VK6IR and others are rumoured to be considering a DXpedition to both Christmas Island and Cocos Keeling Island, but are having problems in finding accommodation.

Father Moran (GN1MM) with Roger G3KMA at a recent get-together of the Chiltern DX group. Photo G3ZAY

Cocos Keeling

The above news item about Cocos Keeling Island is interesting in the light of an item by VK3YJ which appeared in the August 1984 issue of the American *73* magazine. VK3YJ reported that VK9NYG, a novice operator limited to 30 watts PEP and active almost exclusively on 10 metres, made the outstanding total of 22,000 contacts during a 2 year spell of duty on the island group which is located several hundred miles north-west of the Australian continent. VK9YA was also very active during his various visits to the island. Another call which will be familiar to many is VK9YC, a member of the Clunies-Ross family which was granted all rights to the island by Queen Victoria in 1886.

With these and other occasional operations most active amateurs have worked the islands and demand for an expedition might be expected to be low. However, Australia has been seeking to oust the Clunies-Ross family from the islands and is presently building a six million dollar high-security quarantine station there so casual visits by amateurs may become fewer and we may see VK9Y creeping back up the 'wanted' lists.

Africa

ET3PG and ET3PS have both been worked recently in the UK after many years of very low amateur activity from Ethiopia. One wonders if there is any connection with the current Western interest in Ethiopia due to the famine. Also from Africa comes news that ZS2MI may soon be active again. This call is allocated to the weather station on Marion Island which counts as a separate DXCC country. The prospective operator is ZR6AOJ, a VHF-only licence holder who has special permission to operate on HF when on an island assignment (shades of Class B UK licence holders being allowed to operate HF from ZD8, VP8, etc). Finally, FT8XB is expected to show in the near future from Kerguelen Island, a remote French outpost in the Southern Indian Ocean. The QSL route for this station will be PO Box 83, 95101 Argenteuil Cedex, France.

Other news

A recent oddity to have appeared on the bands is UA9OO/YA, claiming to be in a town just inside Afghanistan. We must wait and see whether this turns out to be genuine. YA used to be a common prefix on the bands even though no official licensing procedure existed in Afghanistan. In the early 1970s, however, the authorities clamped down on amateur radio and confiscated equipment. Since then there has been no operation and, since the Russian invasion, very little prospect of return to any kind of normality.

JW0EQ is operational from Svalbard until September, mostly on CW, and has been reported on 160 metres as well as the higher bands. His QSL manager is LA5NM.

With regard to the new (WARC) bands, it is reported that Swedish amateurs have been allowed to conduct test transmissions on all three of these bands since 1 December.

Contests

G3TXF has been doing a good job elsewhere in this magazine of keeping you abreast of forthcoming contests. Can I, however, draw your attention especially to the following contests which take place during February. The RSGB's 160 metre contest takes place from 2100 GMT on 9 February to 0100 GMT on February 10. The ARRL CW contest takes place over the full weekend of 16-17 February.

The last weekend of February (23-24) sees no less than three major contests: the CQ WW 160 SSB (there is no requirement for the serial number to be given in either this or the CW event at the end of January, please correct the rules given by Nigel last month), the French SSB Contest and the RSGB's 7MHz CW event. Flavour all this with numerous American 'QSO parties' on different weekends of the month and there should be a contest flavour to suit all tastes. Well, after all, what else is there to do before spring arrives?

Operating ethics

Finally, I note that ZS6BUX and ZS6DM seem to have incurred the wrath of the Botswana authorities during a recent DXpedition from there. It is not clear from the letter reproduced in *DX News Sheet* just what it was that they did wrong, but there is a salutory lesson to be learned. Not everyone is either sympathetic to or understanding of amateur radio – it behoves us, when guests in another country, to behave impeccably at all times. Bear this in mind if you are contemplating any operation overseas, either in a small way during a European holiday, or as part of a major DXpedition.

Amateur radio can be a marvellous way of building international harmony and goodwill, but can also, if misused, have entirely the opposite effect. Remember always to be ambassadors for this great hobby of ours.

When writing, please remember my new address; 105 Shiplake Bottom, Peppard Common, Henley on Thames, Oxon RG9 5HJ. 73s and good DXing.

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ANGUS McKENZIE TESTS:

Fairly hard on the heels of the Icom IC271H high power 2m multimode is the 471H, having virtually identical facilities but on the 70cm band. The coverage is from 430 to 439.999MHz and modes included are FM, USB, LSB and CW. The rig is similarly styled to other Icom transceivers and is virtually identical to the 271H. The nominal maximum power output on all modes is 75W. Built-in up and down repeater shifts are incorporated, the actual transmit shift being set by the user, which then holds until it is changed on some future date. Two VFOs are included with the usual split mode, A = B, sweeping and scanning facilities.

THE ICOM IC471H 70cm MULTIMODE

32 memories

Thirty-two memories are incorporated which hold frequency mode and repeater offset. It is simplicity itself to put a frequency etc into memory and you can select VFO immediately from any memory, which is very useful. Memories 1 and 2 are used for program scan which allows you to scan all channels, or only channels of the chosen mode.

Receiver incremental tuning (RIT) allows the Rx to be offset up to ± 9.9KHz, the frequency offset being indicated on the digital readout which also indicates main tuned frequency to the nearest 100Hz. RIT can be switched in or out on one button and can be returned to no offset with another, a multi-turn pot providing adjustment of RIT.

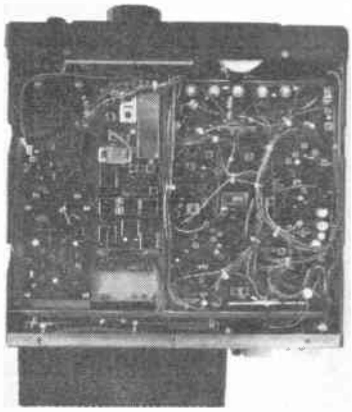
Other buttons switch MHz up and down, select normal or split operation, allow the memory channel to be preselected in readiness and select tuning steps which are 1KHz on all modes with the button in, or 10Hz/5KHz steps on SSB and CW/FM respectively with the button out. When the dial is rapidly rotated on SSB or CW the 100Hz step mode is engaged to give a higher QSY speed which is quite useful. A row of push buttons on the left of the tuning knob select VOX on/off on both SSB and CW, noise blanker on/off, AGC fast/slow, meter (selects discriminator centre O or S-meter on FM reception), masthead pre-amp on/off (13V dc positive on co-ax inner to antenna in Rx mode when switched on, compatible with SSB Products, Dressler and Icom masthead pre-amps) and finally, mode selective scan switch which works in conjunction with memory scan. The four mode switches are in a vertical line on the front panel to the left.

An eight pin socket on the front panel is for microphone interconnection, the mic supplied (HM12) including the usual PTT and up and down buttons, the latter switching memories where appropriate as well as shifting frequency in VFO mode. Concentric split rotaries are provided for RF and AF gain, Rx tone control and squelch (operating on all modes) and output power from 10W to full output combined with mic gain.

To the bottom left of the tuning knob is a push button entitled 'lock'. This not only locks frequency but also activates the speech synthesiser (optional accessory) if fitted, when pushed in. This synthesiser, type ICEX310, costs an additional £39 but does not have quite as many functions as its Trio equivalent.

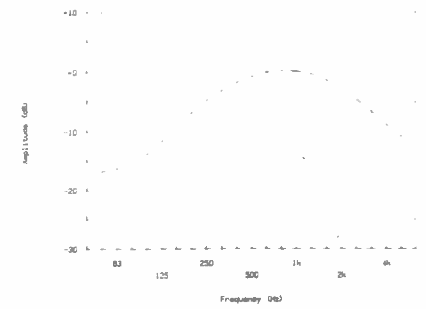
The remaining front controls include mains on/off (this works on either 13V dc input or mains input), Tx/Rx MOX switch and six more miniature buttons selecting offset write (for selecting various repeater shifts which the rig can put into non-volatile memory), check button, which allows you to read the Tx frequency when on Rx for setting offsets (allowing one to listen on repeater input), repeater plus shift or minus shift, tone burst button and tone select button (selective calling, not normally used in the UK).

The fluorescent display indicates frequency, repeater shift status, mode, memory channel pre-selected, RIT, if in use, VFO and various other status functions. The S-meter is to the left of this display and is illuminated. This reads output power on transmit. The quarter-inch headphone jack on the front panel can be used for mono or stereo headphones. On the top panel is a removable bug hutch cover revealing five preset finger turn POTs for adjusting CW delay, VOX delay, VOX gain, anti VOX level and CW side tone monitor level. The loudspeaker faces downwards, halfway back towards the left. There is a bale stand under the front which when brought up allows audio to be reflected forward by the bench.

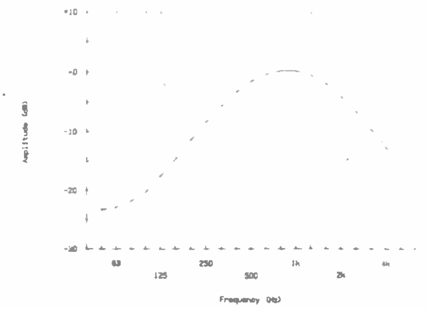


On the back is a massive heat-sink with fan for the high power PA, the fan speed automatically switching to very fast for heavy duty cycles. The RF output socket is N-type which is excellent, although its position is a little cramped. The review sample operated just on 13V dc, but an additional accessory is a plug-in mains PSU, PS35, costing around £165 extra, the rig itself with mic costing £995 at the time of writing. 3.5mm jacks are fitted for Morse key and external speaker interconnections, the latter being very awkwardly positioned extremely close to the RF out socket. Below this incidentally, is a clamp-type earth connector.

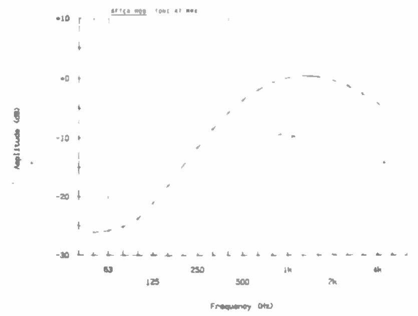
A 24 hole accessory socket provides the following functions: pin 1 – output from squelch control stage (+8V when squelch is operating), pin 2 – 13.8V dc when the rig is switched on, pin 3 – external PTT input, pin 4 – audio output at fixed level before gain control, pin 5 – output from mic pre-amp/input to Tx gain



FM received audio response before mod, tone ½ way up



FM received audio response before mod, tone at max



FM received audio response after mod, tone at max

pot, pin 6 – 8V dc present on Tx only, max 5mA, pin 7 – external ALC input, pin 8 – ground, pin 10 – voltage across internal meter, pin 12 – input control voltage for noise blanker, pin 13 – input voltage for operating FM squelch, pin 14 – input voltage to operate SSB/CW squelch.

The remainder of the pins have no connections. When using an electronic key, note that the key down voltage must be less than 0.4V to operate with the Icom correctly.

Ergonomics

The tuning knob can rotate very freely indeed which is rather nice, but if you prefer some stiffness an adjustment is provided behind it through a hole in the bottom cover. Most of the ergonomics are well thought out, although I have to admit that both the 271 and 471 rigs take quite a long time to get used to.

I am very surprised indeed that once again Icom omit a basic 'short to ground on Tx' socket for operating external linears. It would also be an advantage for Icom to provide a means by which you could limit the power output under all circumstances to save 5W PEP, again for operation with the linear by switching out the mains PA. However, there is a blank panel on the back behind which you can fit a digital interface unit, type ICEX309, for driving everything off a computer.

The high power PA incorporates two 2SC3102 in push/pull. The high power aerial changeover relay is a CX120P which Icom claims has a very low through loss. The output is extremely well filtered, the filters also acting on the Rx input.

The first Rx RF stage is a dual gate MosFET type 3SK48 followed by a 2SK125 which drives into a dual gate MosFET mixer type 3SK102, the first IF being at 70.15MHz. The second IF is 10.7MHz, whilst a third is at 455KHz and is used only for FM.

The audio Rx board is identical to that used in the 271H and therefore has the same evils. The audio gain control is a variable resistor which is varied by dc control and the top 35% of travel has almost no effect, almost all the effective control being right down at the bottom, which is inconvenient. The received audio responses seemed very muffled, especially on FM, and this was confirmed in the laboratory tests. A very significant improvement can be made to the received response by making two component changes: R208, 120K, change to 22K, and C165, 0.047μF, change to 0.0047μF. This will allow the tone control to have a wider range and thus gives a flatter response which improves intelligibility.

I used the rig with my SSB Products' GaAsFET masthead pre-amp and the pre-amp switch worked extremely well with my masthead. Despite my only having around 2dB loss in the aerial co-ax there was an astonishing improvement to the system noise figure when the masthead was switched in, the barefoot rig being a little disappointing, although around average for a Japanese black box.

The reciprocal mixing performance was acceptable but very strong signals seemed to spread quite a bit, most of this being breakthrough at an ever increasing audio pitch as one tuned away. The apparent selectivity is very good however on normal signals, whilst on FM it is excellent. The audio quality, apart from response, was quite good, although power output was a little limited into 8 ohms.

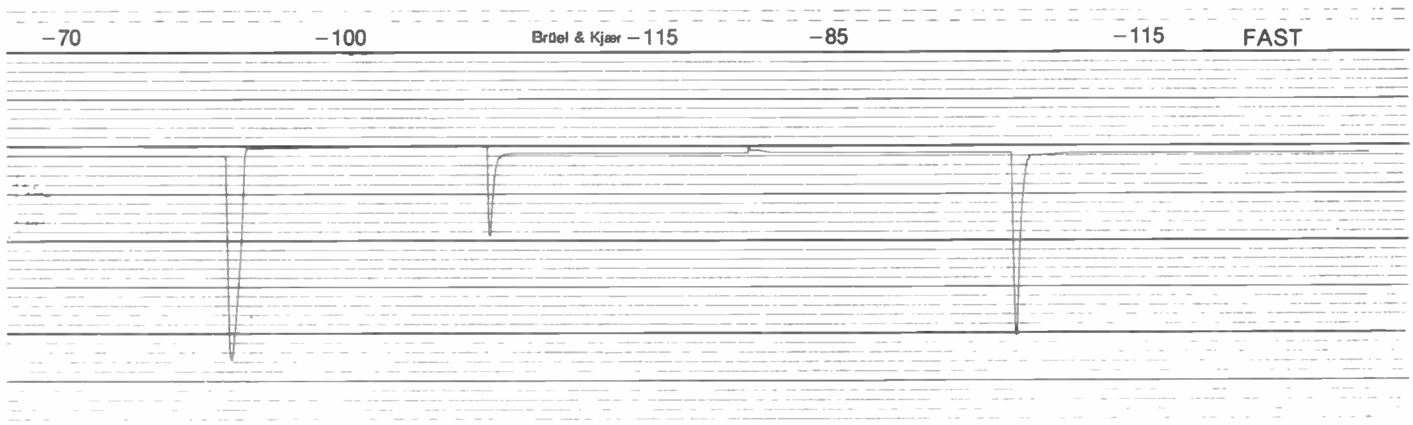
I noted that with RF gain at maximum the onset of AGC was at a surprisingly low level, the S-meter seeming reasonably sensitive. As seems usual with Icom there are offsets of 3KHz when you go from USB to LSB, and 800Hz on CW, and this is infuriating if you want to change from SSB to CW in the middle of a QSO. The AGC characteristics were well controlled and about right (see pen charts). It was slightly annoying that one could not operate the VFO in 25KHz steps on FM and perhaps Icom need to have a think about this.

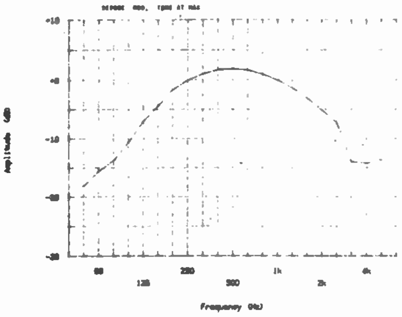
Transmit quality

Most amateurs quite liked the transmit quality, especially on FM, and distortion was at quite a low level. We noticed one very odd thing when we interconnected an external speaker – a whistle at around 16KHz was audible but at a fairly low level all the time on Rx, irrespective of gain control setting or squelch (it actually measured 16mV). This turned out to be breakthrough from the mini switched mode inverter which supplies juice to the frequency display, and surely Icom could add an appropriate capacitor somewhere. I have to admit that I couldn't hear this whistle myself, but my younger colleagues certainly could and found it a little annoying.

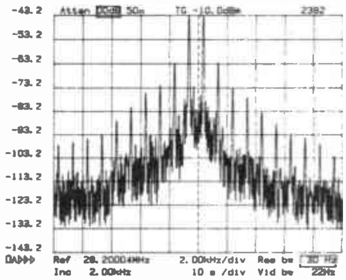
There is no doubt that the mic amplifier circuitry is far more appropriate than on older samples of the 271E, so it seems

AGC response FAST (paper speed 10mm/sec, pen speed 500mm/sec)

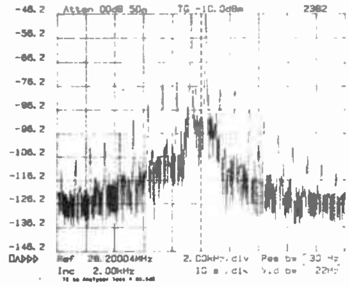




SSB received audio response before mod, tone at max



Intermodulation distortion products full power (86W)



Intermodulation distortion products half power (43W)

that Icom do take note of some criticisms. The transmitter side was a pleasure to work and no problems were noted in operation. Power as factory set is controllable from around 10W to 80-odd watts output by the power control, but there are useful internal presets for adjusting both minimum and maximum powers and you could of course use this to obtain the required minimum power for operating a very high power linear. If this is the case you might prefer to consider the lower power version which is identical in every way but has a maximum power output of 25W (IC471E).

The instruction book is reasonably well presented, but there was one baffling point – the labelling of the Rx input board coupled with some other circuitry as 'RF.YGR'. After considerable thought as to what YGR stood for Thanet Electronics revealed the true answer – the letters stand for 'younger', the Japanese interpretation of 'earlier stages'!

Laboratory tests

The Tx section gave well above the rated power at the bottom and middle of the band, but power fell back to only 70W at the extreme HF end. Power control was very smooth. Carrier rejection was excellent as was sideband rejection. The output frequency accuracy on FM was reasonably good, although CW had a 650Hz offset. The repeater shift accuracy was excellent. Maximum deviation on FM was very well controlled and certainly not excessive, with tone burst deviation set just about right. Tone burst frequency, incidentally, was exceptionally accurate. RF harmonics were well below −65dB ref carrier which is superb, especially considering the high power PA.

The transmitted audio frequency response on FM from the mic input socket to the output carrier, when checked with 750μS de-emphasis, was within 3dB from 500Hz to 2.5KHz and outside this band attenuation was gradual at the LF end, whilst very rapid above 3.5KHz. The response thus seems about ideal (see pen chart). We also checked the response with the rig around 20dB into limiting and it can be seen that over deviation is avoided. The maximum current drawn on Tx from 13.8V dc is 19 amps, so you will need a fairly elephantine power supply, even Rx drawing 1.6 amps.

The receiver input noise figure was calculated to be around 5.5dB, not bad but it could be a lot better. Thus, the rig was a little insensitive on all modes, thereby explaining why the apparent sensitivity improved so much when the masthead pre-amp was switched on. The RF intercept point did not measure particularly well, but I suppose it is not bad in the context of 70cm average working. With the masthead pre-amp on though it deteriorates considerably of course, and since this is necessary for DX operation, it shows that Icom's circuitry is not really good enough here.

We did not note any particular reciprocal mixing problems and IF selectivity on FM was very good, but we were dismayed to find a serious problem on SSB/CW. The IF board is the same as that on the 271H and, once again, there seemed to be bad breakthrough around the filter to the product detector circuit. This resulted in good selectivity measurements down to −40dB, but −60dB was appalling, getting rapidly worse even at −63dB, selectivity at −70dB being as wide as 25KHz.

We were able to tune up and down across a strong carrier and note higher and higher pitch audio breakthrough to confirm this problem. A 1mV input signal for example was audible from ±20KHz or so, around the limits of Jonathan's hearing! Icom will have to do something about this.

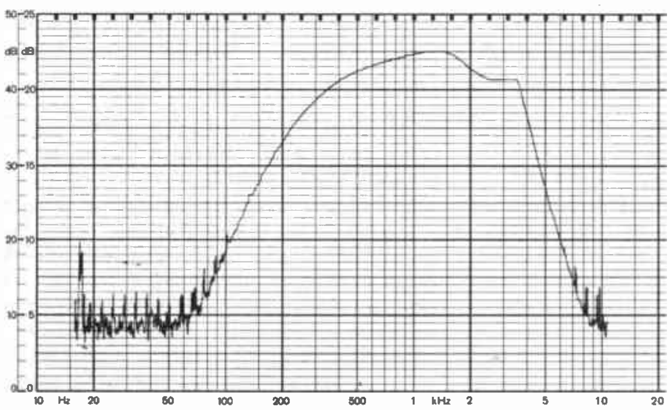
FM limiting

FM limiting was reached at an extremely low RF input level which is good, and distortion on low level signals was quite reasonable. The S-meter gave the usual ridiculous small range on FM which seems common with almost all rigs, but had a very useful range of 33dB on SSB/CW between S1 and S9, although it was a little cramped at the top end.

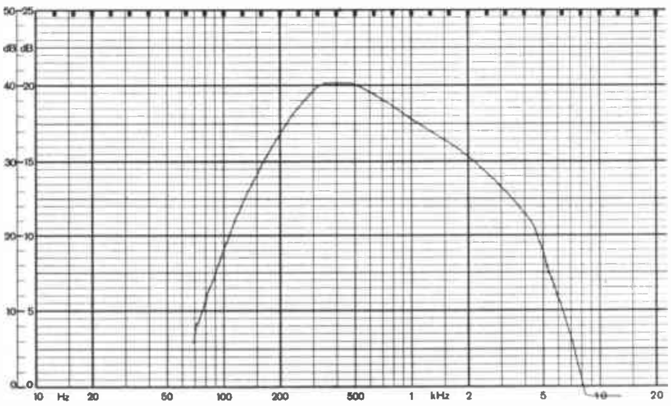
Distortion was reasonably low on FM at normal levels, whilst product detector distortion on SSB was quite acceptable, although we have seen better. The maximum audio output power was, indeed, a little limited and below specification into 8 ohms and only gave another watt output into 4 ohms, which shows the limitation is clearly in the chip itself.

The capture ratio on FM was very good indeed thus showing excellent discrimination between stronger and weaker stations on the same frequency. I must particularly commend Icom for the excellent attainable best signal-to-noise ratio, both unweighted and weighted on the output if one filters out the switched mode breakthrough. Good quality FM

Transmitted FM response (750μS de-emphasis)



Transmitted FM response, 20dB into limiting (750μS de-emphasis)



transmissions were a delight to listen to on a good quality external speaker once my colleague had modified the de-emphasis circuits.

We charted six different Rx responses, four on FM and two on SSB. Before modification there was far too much HF cut on all modes, resulting in a clothy reproduction even with tone control flat out. We discovered to our amazement that the tone control seemed to boost mid when turned above halfway, making the sound even squawkier, although this was improved after modification. The bass end is reasonable enough but slightly more bass is cut out with the mod. However, you will see that the HF end vastly improves with the mod.

ICOM IC471H LABORATORY MEASUREMENTS

Transmitter Measurements			
Maximum RF output power (max/min)			
	FM	SSB	CW
432.025MHz	86/10W	86/10W	84/11W
433.4MHz	84/11W	84/11W	84/11W
439.975MHz	70/9W	69/9W	70/9W
Tx frequency accuracy			
	FM		+370Hz
	CW		+650Hz
FM carrier drift: full power for 1 minute			none
Repeater shift accuracy			within 10Hz
Toneburst deviation			3.7KHz
Toneburst frequency			1750Hz within 1Hz
Maximum normal deviation			4.8KHz
Maximum provoked deviation			5.2KHz
Tx harmonic distortion			less than -65dB ref carrier
Carrier rejection			-52dB
Sideband rejection at 1KHz modulation frequency			better than -70dB
Receiver Measurements			
Sensitivity (FM 12dB Sinad)			
432.025MHz			-121.3dBm
433.4MHz			-121.6dBm
435.975MHz			-122.0dBm
439.975MHz			-122.4dBm
Sensitivity (SSB 12dB Sinad)			
432.25MHz			-125.4dBm
Selectivity			
FM, blank carriers off channel to degrade Sinad by 3dB			
+/- 25KHz spacing			67/66 dB
+/- 50KHz spacing			69/69 dB
Selectivity			
SSB			
3dB Bandwidth			2.3KHz
6dB Bandwidth			2.4KHz
40dB Bandwidth			3.5KHz
60dB Bandwidth			11KHz
63dB Bandwidth			19KHz
70dB Bandwidth			25KHz
RFIM Performance (FM)			
Carriers off channel for 12dB Sinad product (ref 12dB Sinad)			
50/100KHz spacing			67dB
100/200KHz spacing			66.8dB
Calculated Intercept Point			-20.5dBm
S-meter			
RF Levels required to give the following meter readings			
	FM		SSB
S1	-109dBm		-116dBm
S3	-103dBm		-112dBm
S5	-100dBm		-107dBm
S7	-97dBm		-95dBm
S9	-95dBm		-83dBm
S9+20	-92.5dBm		-70dBm
S9+40	-90dBm		-61dBm
S9+60	-79dBm		-51dBm
Capture ratio (FM)			3.7dB
Audio quieting (FM, at 12dB Sinad)			15.5dB
RFIM performance (SSB)			
(ref 12dB Sinad)			
+20/+40KHz spacing			70.4dB
+100/+200KHz spacing			69.4dB
Calculated intercept point (SSB)			-20.5dBm
FM 3dB limiting point			-125dBm
Maximum audio output power (10% THD, FM, 1KHz tone, 5KHz deviation)			
into 8 ohms			1.8W
into 4 ohms			2.7W
FM Audio distortion (125mW into 8 ohms)			
1KHz deviation	3.5%		
3KHz deviation	1.4%	(Maximum attainable distortion, volume fully up, at 3KHz deviation was 6.6%)	
SSB product detector distortion (at -80dBm)			2.4%
FM best obtainable signal-to-noise ratio			
Unweighted;			61dB
CCIR/ARM weighted;			60dB
Current drawn at 13.8Vdc, FM			
Rx;			1.6 amps unsquelched
Tx;			8 - 19 amps
Size; 125mm (H) x 300mm (W) x 324mm (D) inc projections			
Weight; 7.1Kg			

On SSB, the normal response is virtually an inverted 'U' shape, the flat part being very narrow, only around 1KHz of bandwidth, thus contributing to the very middy sound quality. Matters did not improve much with the mod and I cannot see why we cannot have a flat audio bandwidth after the detector from 300Hz to 3KHz, allowing the IF filter to give effective bandwidth control in the normal way.

Received frequency accuracy seemed to be around 1KHz offset on FM for best performance, and we noted a 250Hz error on SSB.

The new Marconi 2382 spectrum analyser arrived just a few hours before this review was delivered to the editor, and we were thus able to take some two tone plots showing the intermodulation distortion present in the RF output of the rig (see illustrations). At full PEP output the third order products were at −20dB, whilst at a total bandwidth of 20KHz, ie at ±10KHz, the IPs had reduced to an average of −57dB.

At half power, ie around 44W PEP output, the ±10KHz bandwidth gave IPs at -66dB, whilst the third order product averaged at −30dB. A two tone test represents the worst possible case for producing intermodulation, and so I regard the full power performance as adequate whilst half power performance is excellent. We mixed down the attenuated Tx output to a level of around −30dBm into an MCL mixer with IF output at 28.2MHz into the analyser, as the 471H output frequency is just slightly higher than the 400MHz limit of the analyser.

Conclusions

I cannot help but feel that this rig is overpriced for its facilities and performance, and this is particularly unfortunate since competition is very stiff for Icom. If you want a rig which will give a surprisingly high output power and you are prepared to accept the problems outlined above then you will probably be quite happy with it, especially if you also splash out on a masthead pre-amp to go with it.

The speech frequency read-out option will obviously be a boon for white stick operators, but I feel that we should all wait to see how the Trio TS811 fares for it may be a better buy. The rig is very well built, and of course the back up service from Thanet is excellent. I cannot see this rig being a top seller, but even so it has some good points, and perhaps Icom will introduce some improvements.

In the meantime, I will have to recommend the combination of a suitable secondhand HF transceiver with a Microwave Modules 70cm transverter and linear – a much better buy.

I would like to thank my colleague Jonathan Honeyball for the vast amount of work that he undertook in helping me take all the measurements, and Thanet Electronics for kindly loaning the review sample and for their time and patience discussing many of the points raised.

ICOM IC04E 70cm HANDHELD

In the May 1984 issue I reviewed the IC02E, the 2m version of the model surveyed here. The facilities and layout of the IC04E are virtually identical to those of the 02E.

The rig is supplied with a miniature 70cm rubber duck which is very thin, the length being around 16cm from the back of its BNC plug to the tip. On the top of the front panel is an LCD display indicating frequency, repeater shift information, sub-audible tone on/off, low battery state, T for Tx etc. Beneath this display is a matrix of 4 x 4 push buttons for selecting frequencies from 430MHz to 439.975MHz, the rig being channelled to the nearest 25KHz frequency.

Ten memories are incorporated together with a priority channel, scanning, memory to VFO and various other facilities described in the 02E review. The buttons are actually labelled 1 to 9, 0, asterisk, hash, A, B, C and D. A is either clear or scan stop, B is memory read or write, C is memory scan or programme scan, whilst D is call or lock.

If you wish to transfer from memory to VFO you have to press the A button for clear. The numbered buttons are multifunction as usual. Underneath this push pad is a small loudspeaker below which is the rechargeable battery pack, the review sample version being 8.4V nominal.

On the left side cheek there are three buttons; the main PTT with repeater tone burst button at its top, whilst above this the function shift button which enables all the second functions of the main push pad. On the top of the rig is the BNC socket for the antenna, below which are illuminated on/off and high/low power buttons. To the right are the on/off and volume controls, complemented by the normal squelch control; these are all very easy to use and well positioned.

Three miniature sockets on the top panel are provided for external input dc volts, external mic and speaker interconnections. On the back is a very strong spring loaded belt clip.

Internal mic

The internal microphone is built into the loudspeaker on the front panel. On the back of the battery is another dc input socket labelled 'dc 13.8V'. This, at first, was rather baffling until we resorted to reading the 'destruction book' which, incidentally, does not give information which you may need to have in a hurry, although circuit diagrams, which are reasonably easy to see, are included.

The batteries' 13.8V input is actually intended for a charging connection, and there is a resistor between this and the battery to limit charging current. The positive feed from the battery is taken directly up to the top deck and through to a relay which is also connected to the top dc input connection. Under normal use with internal batteries juice is taken straight through to the rig's on/off control, but when external dc volts are plugged into the top the relay becomes energised and applies the external voltage directly to the rig, whilst disconnecting the battery feed. There is, therefore, a standing current of 23mA when the rig is used on external voltage, even when it is switched off.

A battery charger is supplied with the rig which takes around 14 hours to fully charge the battery, but of course charging can be accomplished without removing the battery, although it is unwise to use the rig when it is being charged. There is a totally ludicrous situation here in the choice of polarity of the little dc input sockets, for Icom choose to use the complete opposite to Yaesu, thus giving total incompatibility with external dc leads and chargers. The Icom centre pin is positive whilst the outer is negative, and although a few other manufacturers use this crazy convention, by far the majority go the other way around, which is standard. Most sockets allow the positive feed to be back-connected when no plug is inserted, and break the connection appropriately when the plug is put in. It strikes me that this is a far better way of disconnecting the battery than Icom's expensive way of using a relay!

I am afraid I have to have a moan again about Icom's crazy software logic. As with the 02E I spent over an hour trying to sort out the logic of the keypad and, whilst memory 1 is the priority channel, many amateurs would want it to be a simplex one for emergency or Raynet use. Insertion of a simplex frequency in memory 1 precludes repeater shift being stored in memories 2 to 6, although if you attempt this, there is an indication on the LCD that it has stored shift. It is therefore a surprise when for the first time you assume that you are shifting up on Tx from memory 3, for example, and find that your output frequency is still repeater output! For some inexplicable reason, memories 7, 8, 9 and 0 are independent from memories 1 to 6, and do not have this problem. This is obviously a software writing mistake and since Icom have probably ordered 10,000 or more chips they obviously would not wish to redesign them and have to throw the faulty ones away!

Logic?

One other piece of logic that seems crazy to me is that if you have entered a repeater shift on a particular frequency you lose the shift immediately you go up or down one channel, thus making it impossible to hunt repeaters when you are in an unfamiliar location. I freely admit that under normal circumstances most users would only require perhaps four repeaters, but in many areas I find that I regularly use at least six from the same location.

You may think it is easy enough to enter a repeater shift, but unlike the Yaesu operation of only two buttons, the

Icom requires you to hold in the function button, then press shift followed by + and then 160, the latter representing 1.6MHz. After entering this you then release the function button. The necessity for pushing six buttons seems ridiculous and I feel Icom will need to rethink this.

For entering a repeater shift in memory you first select frequency, then repeater shift and continue to hold the function button down whilst pressing button B, followed by the required memory channel, after which your tired thumb can be released. For entering normal frequency you have to put in MHz followed by two figures, the rig then going to the nearest 25KHz channel.

Subjective tests

I tried this little rig a number of times, having mastered the dreadful ergonomics, and found it reasonably sensitive and giving quite good quality on receive. As is the case with so many walkie-talkies, the available volume from the speaker was not really high enough and for mobile use most definitely inadequate unless you use some form of audio power booster, eg the new Heil one. There was a tendency to boominess on the internal speaker, although the sound was always clear and certainly not coloured.

Many stations reported that the transmit audio quality was good, with excellent limiting. The higher than usual power on Tx was also a help, but power consumption is fairly high. Sometimes I found it slightly irritating that when changing channel the rig took a fraction of a second to activate the command, but I must admit that I am an impatient soul. I liked the general feel of the rig, but having reviewed the Trio TH21 I wonder whether even the reasonable weight of the 04E isn't a little more than it need be in terms of the latest high tech.

The input sensitivity did not seem quite so good as that of the old IC4E, but selectivity seemed adequate for all requirements. No technical problems arose.

Laboratory tests

You will see from the test figures shown that the 12dB sinad sensitivity averaged around 2.5dB worse than that of the old 4E. I find this a little disappointing and cannot see why this should be so. Selectivity however measured extremely well. The RF intercept point, as with its predecessor the 4E, is poor and you will find that you may get problems trying to receive a DX repeater on, say, RU6 if RU2 and RU4 are very strong. What you may hear is two repeater QSOs at once taking place on top of the distant repeater that you wish to hear, and you might well imagine that it is a form of jamming rather than a rig design fault. On looking back at my old results for the 4E, I note that the 04E is just 2dB better here, whilst the old FT708 Yaesu is very many dBs better.

The S-meter is in the form of a row of LCD dots at the bottom of the display, the most sensitive indication being for an input signal of 1μV, whilst they all light up with a signal only 11dB stronger. Limiting was excellent, the limiting point being well below that of the sinad sensitivity. Distortion was at quite a low level for 125mW output.

The quieting ratio at the 12dB sinad point was virtually identical to it, showing extremely low distortion of low level signals, which is excellent. Available output power is, of course, rather limited but I suggest that the built-in speaker is more inefficient than usual. Capture ratio is extremely good showing that a slightly stronger signal will capture reception quite effectively over a weaker one.

The overall frequency response from a 750μS pre-emphasised transmission was stunningly flat from around 400Hz to 3.8KHz. This perhaps is a bit too wide especially as 200Hz is only 7.7dB down,

ICOM IC04E – LABORATORY RESULTS

Receiver Measurements

Sensitivity (for 12dB sinad)

432.025MHz	-121.2dBm
433.400MHz	-121.3dBm
435.975MHz	-120.3dBm
439.975MHz	-119.3dBm

Selectivity
(blank carriers off channel to degrade sinad by 3dB)

+/- 25KHz spacing	65.6/65.5dB
+/- 50KHz spacing	71.8/71.8dB

RFIM Performance
Carriers off channel for 12dB sinad product (ref 12dB sinad)

50/100KHz spacing	76.8dB
100/200KHz spacing	74.4dB

Calculated Intercept Point	-35.5dBm

S Meter Readings
RF levels required to illuminate the following LCD bar pairs

1st pair Always on	9th pair -100dBm
2nd pair -107dBm	10th pair -99dBm
3rd pair -105dBm	11th pair -98.5dBm
4th pair -104dBm	12th pair -98dBm
5th pair -103dBm	13th pair -97.5dBm
6th pair -102dBm	14th pair -97dBm
7th pair -101dBm	15th pair -96dBm
8th pair -100.5dBm	

Capture ratio	4.0dB
Audio quieting (at 12dB sinad point)	12dB
3dB Limiting Point	-125.9dBm
Maximum Audio Output (10% THD into 8 ohms)	0.4W

Audio distortion (125mW into 8 ohms)

1KHz deviation	2%
3KHz deviation	1.4%

Transmitter Measurements

Maximum RF output power

	Battery (high/low)	Ext 13.8V (high/low)
430MHz	3.2/0.5W	5.5/0.51W
433MHz	3.1/0.5W	5.2/0.5W
434.6MHz	3.0/0.5W	5.2/0.5W
439.5MHz	2.9/0.5W	5.2/0.5W

Carrier frequency accuracy

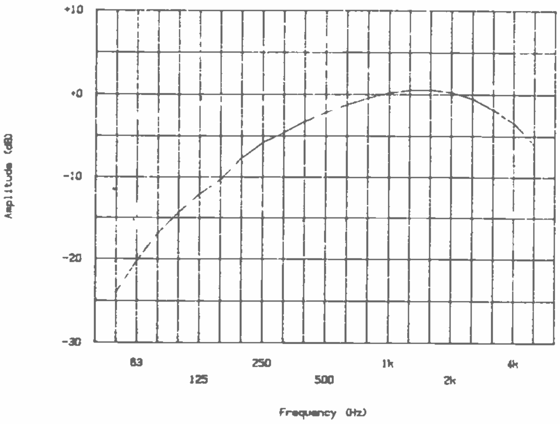
433MHz	Maximum +60Hz
439.5MHz	Maximum +20Hz

Repeater shift accuracy	30Hz low (see review for memory comments)
Peak deviation (loud shout)	5.6KHz
Tone burst deviation	3.6KHz
Tone burst frequency	1750Hz within 0.5Hz
Tx harmonic distortion	Both 2nd & 3rd below -60dB ref carrier

Current consumption

Tx 1.5/0.59A High/Low	
Rx external power	Squelched; 79mA Half volume; 90mA
Rx on battery	Squelched; 52mA Half volume; 68mA

Icom IC04E FM recieved audio response (750µS pre-emphasis)



clearly resulting in the LF boominess noted subjectively. I would have preferred a steeper bass roll-off in the context of a walkie-talkie.

Both the receiver and the transmitter sections were extremely accurately aligned on frequency, the transmitted error being 60Hz at worst, but averaging only 20Hz for the entire duration of the tests! Repeater shift was also very accurate, within 20Hz. The average maximum deviation was around 5KHz, peaking at no more than 5.6KHz, the tone burst deviation being very well set at 3.6KHz. The tone burst frequency was only 0.5Hz in error, which is again excellent. The transmitted signal-to-noise ratio was excellent showing no synthesiser breakthrough problems.

Harmonics were right down at the noise floor of the analyser below -60dB ref the carrier level. We checked the power outputs both from the internal battery in a half charged state and from an external 13.8V dc supply. On the latter some 5.5W was noted at the low end of the band, reducing only marginally at the top end. On low power the output was approximately 10dB lower which is ideal. When tested on its internal battery maximum power was around 3.2W, reducing to 0.5W average on low power, showing that the source impedance of the battery and the lower voltage are the main reasons for the reduction of high power output, whilst not affecting low power.

The current consumption from external dc is surprisingly high, reaching 1.5 amps on high power Tx, whilst on low power it was still nearly 0.6 amps. On receive, when squelched, the current drain from the battery is a little high at 52mA, rising to an average of around 70mA when receiving a transmission.

Conclusions

From a technical viewpoint this is quite a nice little rig, although you should note the reservations mentioned on Rx sensitivity and intercept point. I have to sum up everything at once though, and for me the serious snag is the very poor ergonomics which is such a pity.

It is difficult to review a rig in isolation and although manufacturers do not like comparisons, readers usually do. I feel that the forthcoming FT709R may well show up the IC04E, when it comes along, as it should have the same excellent ergonomics as the FT209 reviewed in the November issue. Another alternative will be the Trio TH41E which should also be available by the time you read this review, and I hope to review both these rigs eventually.

I can, therefore, only recommend the rig with strong reservations although it will probably become fairly popular, and I must admit that ergonomics are more important to me than to some of my friends. I suggest that you try to compare it with competition prior to purchase and that the FT708 is still the best buy at the time of writing. Needless to say, the rig is beautifully presented and is available in various versions for PMR on various commercial bands, and it is perhaps largely with these applications that the rig has been designed and so perhaps it is the amateurs who have to suffer the consequences.

Size

The rig measures 170x65x40mm (6¾ x2½x1⅝in) including protrusions but excluding the whip and the belt clip. It weighs 533 grams including battery, belt clip and whip and costs £269 including VAT with rechargeable BP3 battery pack, mains charger, rubber duck and carrying strap included. Optional extras including various battery packs, speaker/mic and headset were listed in the IC02E review. I would like to thank my colleagues Jonathan Honeyball and Nigel Bickell, both of whom have recently taken the RAE and who are hoping for the best, and Thanet Electronics for the loan of the review sample.

G3OSS UPDATES

Yaesu FT209R
November 1984

Since writing my recent review of this product in this magazine, I have heard from retailers that one or two purchasers have had a minor problem with the rig when using it with a large outside aerial as a base station set-up. My advice was requested and I felt that the situation was sufficiently important to write this brief note.

The Rx front end is rather broadly tuned and so if strong signals are present well outside the 2m band, severe interference can be caused to the reception of 2m signals resulting from front end blocking. I created the problem for myself by putting the full output from my 8/8 vertically mounted J beam through a bomb proof pre-amplifier into the rig, and found that even some repeaters became almost inaudible.

I then put a Trio 2m band pass filter immediately in front of the rig and the problem completely vanished. I believe that this filter is no longer available and so tried the latest Mutek 2m bandpass filter which also virtually cleared the problem. This is supplied with BNC sockets and seems most effective having minimal loss.

It serves as a warning though that using walki-talkies for base station use can be driving them further than is fair, but at least this time there is a cure.

Tau SPC 3000 ATU
December 1984

When I reviewed the Tau ATU recently I passed a comment that they should be improving the accuracy of the SWR measurements. They recently informed me that they had done this and also, at my suggestion, Tau have now incorporated 6:1 reduction drives on the two capacitor controls. Each knob now has a transparent flange behind it, and behind this is a pointer which moves slowly across the 1:10 scale as the main knob is rotated at the faster speed. The result is a beautifully smooth tuning action.

I decided to purchase one of these, which arrived just before sending copy to the publisher, but alas my own purchased unit, when delivered, did not work at all. On opening it up we found that the problem was due to a dry joint which was soon repaired. Then we discovered that the power meter did not work either and, on further investigation, and upon repairing another dry joint, everything sprang to life!

The SWR readings are now a little bit more accurate than before but nowhere near accurate enough, so we dug inside and attempted recalibration by adjusting presets. This slightly improved matters. Tau will have to do something about this and have promised to do so yet again. I am rather worried about dry joints and the fact that we had to take the ATU completely to bits in order to put it right; thank goodness we did not have any spare bits left over on reassembly!

Tau are in the course of preparing new meter labelling with more detail as I have suggested. Finally, it was rather exasperating to find that one of the bolts was of an incorrect type and did not fit properly, so I had to replace it by one more or less identical to all the others.

South Midlands

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FRG8800

General Coverage
Continuous coverage from 150KHz to 30MHz. Two speed spin tuned VFO plus keyboard plus computer interface control.

All mode
The FRG8800 demodulates SSB (USB & LSB) CW, AM (Wide and Narrow) and FM narrow as standard. This, complemented by an all mode squelch, produces the most practical receiver available. The FM narrow is useful for 10M, CB and for VHF with the optional VHF convertor.

Memory
The FRG8800 comes fully equipped with twelve memories programmed and scanned at the touch of a single button. Any of the memory channels will accept a frequency within the whole range of the receiver including the VHF range (with the optional VHF unit). The mode is also stored in the memory eliminating the need for inconvenient manual mode change, when hopping from one memory to the next.

Selectivity & Sensitivity
Four filters are fitted as standard (SSB/CW, AM, AM-NAR and FM-NAR) with bandwidths chosen for optimum performance, these combined with switchable AGC and variable tone control provides maximum enjoyment despite today's crowded bands.
High input sensitivities are obtained by the latest in RF stages, making the most of inefficient aerials and difficult locations, and a continuously variable RF attenuator control overcomes problems encountered with very powerful stations.

LCD Display
The back-lit green LCD display incorporates easy to read 'any angle' 10mm digits.
A twelve function display indicates the transceiver's status at a glance. It includes memory channel number, mode, and frequency to a resolution of 100Hz. Also included is a two dimensional LCD, graphical SIMPO and 'S' meter, which is conventionally calibrated at 1-5 and 0-9, +20dB, +40dB, +60dB respectively.

Keyboard
A 12 button keyboard is fitted as standard allowing quick accurate changes of frequency and band (MHz and KHz programmed individually). The keyboard also has nine control buttons to allow rapid changes from memory to VFO, memory to memory and VFO to memory. Memory channels can also be recalled at the turn of a knob, ideal for storing calling/working channels or broadcast reception.
The keyboard is complemented by an opto-coupled, two speed, VFO drive: fast for rapid tuning of a band or slow for accurately tuning in a signal. In addition a fine tune control compensates for drift in the received signal. The dial can be electronically locked preventing accidental change in frequency.

Clock/timer
Dual accurate 12 hour clocks, with AM/PM indicators are ideal for log keeping (GMT/Local). The clock uses the main digital display and features full back-up facilities in the event of a mains failure or disconnection. The timer can activate the receiver or tape recorder via the relay contacts provided. A snooze facility allows up to 59 minutes of listening.

VHF Converter (optional)
The FRV8800 extends coverage to include 118-174MHz all within the main frame, thereby allowing monitoring of; PMR, marine and air bands, as well as 2M.
The FRG8800 is operated as before via the keyboard or VFO, and the memory still holds any frequency and mode. The *actual* VHF frequency is displayed on the main LCD to a resolution of 100Hz.

Worldwide
At 6.1Kg (excluding convertor) the FRG8800 is ideal for taking on any trip. The power supply is easily adjustable from 240-220 VAC to 110-120V, 50/60Hz mains and 12VDC operation is available as an option.

SPECIFICATION

FREQUENCY COVERAGE:
150KHz – 29.999MHz
118MHz – 173.999MHz*

FREQUENCY RESOLUTION:
100Hz (Digital Readout)

FREQUENCY STABILITY:
<± 300Hz in 30 mins after 1 min on
< 50Hz in 30 mins after warm up

MODES OF RECEPTION:
AM, CW, FM NB, SSB (LSB/USB)
A3E, A1A, G3E, J3E

SELECTIVITY:
SSB/CW (J3E/A1A):
2.7KHz @ -6dB, 8.0KHz @ -50dB
FM (G3E) narrow:
12.5KHz @ -6dB, 30KHz @ -40dB
AM (A3EH3E) (standard/narrow):
6.0KHz @ -6dB, 15KHz @ -50dB
2.7KHz @ -6dB, 8KHz @ -50dB

SENSITIVITY:
SSB/CW (J3E/A1A) @ 10dB S + N/N:
<0.4uV into 50 ohm, 1.50-30MHz
<3.0uV into 500 ohms, 0.15-1.6MHz
<1.0uV into 50 ohms, 118-174MHz*
FM (G3E) @20dB S + N/N:
<1.0uV into 50 ohms, 1.60-30MHz
<2.0uV into 50 ohms, 118-174MHz*
AM (A3E) @ 10dB S + N/N:
<4.0uV into 50 ohms 1.60-30MHz
<3.0uV into 500 ohms, 0.15-1.6MHz
<10uV into 50 ohms 118-174MHz*

SQUELCH SENSITIVITY:
SSB/CW (J3E/A1A):
<2uV, 1.60-30.0MHz
<4uV, 118-174MHz*
FM (G3E):
<0.5uV, 1.6-30.0MHz
<1.0uv, 118-174MHz*
AM (A3E):
<2uV, 1.60-30.0MHz
<4uV, 118-174MHz*

AUDIO OUTPUT:
1.4W in 8 ohms internal @ 10% T.H.D.
4-16 ohms external speaker/phones
Constant level line output (recorder)

POWER REQUIREMENTS:
100/120 220/24V @ 50/60Hz
35VA Rx, 5VA standby
12VDC (nominal)*
1A Rx, 0.020A standby

DIMENSIONS (Ex/Inc projections):
335/350 W, 120/130 H, 235/270 D, mm
Weight 6.1/6.3Kg (w/o, c/w VHF unit)

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OMT2700RH	Owners Manual	£2.65

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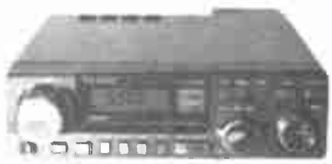

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JUSTICE/INJUSTICE THE SEQUEL

Hugh Allison G3XSE

One man's tale of the relationship between amateurs and the police

A recent article in this learned magazine, entitled *'Justice/Injustice'*, had me spitting blood. I was so incensed with the article that I wrote a letter to this magazine. My letter produced literally hundreds of replies, many even offering me financial support, and asking so many questions that the editor asked me to write up exactly what happened. Here it all is, in chronological order.

24/1/80

At 8.30am I was driving in Harlow on my way to pick up my girlfriend (now the wife). I was enjoying a pleasant chat with Brian G4CTS, on 70cm via a local repeater. A police car pulled in front of me and flashed his 'stop' sign. PC Fincham, PC962, politely explained that the police radio system was being troubled with spurious *'Mayday'* calls and he had reason to believe that I was originating them. He would not indicate his grounds for suspecting me. He wished to examine the equipment in my vehicle, which incidentally comprised two crystal controlled rigs, an IC32 on seventy and an IC22A on two. I explained that the conditions of my licence stated that the equipment could only be examined by a duly authorised person acting on behalf of the Secretary of State, and that he, as an unlicensed person, was not permitted to have access to the station.

PC Fincham politely ignored my request and proceeded to examine the equipment, which included his transmitting into GB3SV and causing it to 'come up'. After a fifteen minute examination PC Fincham declared that he was unhappy about the installation, despite being shown the licence. I explained that I was now late for work, as would be my girlfriend, to which PC Fincham replied he could and would keep me as long as he wished while he examined my equipment.

22/2/80

At 2pm I was working on my car, which was parked on a hardstanding. Alongside was my van, unlocked since I was taking and removing tools from it. PC1469 Crosby and PC592 Andrews arrived and started examining the radios in the van, without asking permission. I again attempted to explain the situation and was told to shut up. I was interrogated for forty-five minutes (again being made late for work). In the end the officers told me that since it was not a *'Summerkamp'* type transceiver it was not on their list and I could 'consider myself let off this time'.

22/2/80-27/2/80

I was stopped a further three times by the police. In desperation I phoned the local police station and an appointment was made to see the collator on 29/2/80. This appointment was made because I was annoyed at the harrassment I was being given by the police (in particular, being made late for work). I was also extremely annoyed by the pure garbage being spoken by the police officers during my interrogations. The officers claimed to be fully trained on all radio matters (it later transpired that this comprised reading one side of an A4 sized sheet of paper!). The most memorable informed comment from a 'thoroughly trained police officer' was and I quote: 'Any transceiver containing more than sixteen channels is an illegal set'.

I was extremely annoyed with being in the impossible position of having to argue with police officers who had been given totally erroneous information; you simply cannot reason with a person who is totally ignorant of the subject under discussion. I also wished to complain about being detained whilst the vehicle was examined for illegal radio installations (a power that the police did not have) and to complain about police officers breaking the law by illegally operating my station, despite my teaching the police the law on the subject.

29/2/80

The day of the meeting with the police at Harlow police station. At 8am I drove my vehicle down the lane to the M11 junction. A police car pulled out from a layby there and 'tailed' me some twelve miles into Harlow. It then pulled in front of me and up came the 'stop' sign. PC1393 Norris refused to show me his warrant card. He insisted that the equipment was CB, despite being shown my licence (I was under no obligation to do this). He also informed me that the licence was out of date (it only shows the first year of issue). Despite being told that an 11am appointment with the collator at Harlow police station had been made, and despite being shown the log book, he charged me with the offence of 'suspicion of using CB equipment'. He wished to examine the equipment, and as I ran through the licence conditions he leaned through the car window, took my vehicle keys and operated the equipment after opening the passenger door.

I was then forced to follow the police car to the Harlow police station, being told that I would be arrested for failing to co-operate with the police if I did not comply. It was unfortunate that PC Norris did not know where the police station was, since I followed him down several dead ends and had to keep backing up out of his way.

At the police station I was told by PC Norris to securely lock the vehicle so that nobody could touch anything, and that I was being taken to see the collator. With amateur licence in hand I was shown into a room and told to stand behind a rail. I was informed that I was being detained on a charge of 'suspected possession of citizens band equipment'. When I protested that the charge had been changed and was still a non-existent offence, I was told to 'shut up, we put what we want'. My possessions were demanded and itemised whilst several other officers in the room made comments, such as 'three dirty snot rags', and my licence was listed as 'assorted papers'. I was asked to sign the list, and when I protested that the licence was not listed I was told by the arresting officer, 'sign it or I'll do it for you'.

I was then told to remove my shoes and was locked up in a police cell. Since the police had removed my watch I had no idea of the time, but would guess at 9am. Whilst being held in police detention I was told that if I would only sign a statement admitting my 'guilt' I would be released. At the time this was a very, very, tempting offer. Police cells are not very pleasant places. I did not sign anything.

At 12 noon I was told by my jailer 'out, you'. I was allowed to put on my shoes and my possessions were returned. I was told that my vehicle had been inspected by *three* officers of the Radio Regulatory Division of the Home Office whilst I had been held in police detention, but my equipment was indeed genuine amateur equipment and I was free to go. The log book had not been signed, as the inspecting officers are required to do by terms of the licence.

Although somewhat disorientated, I then went ahead with my meeting with the collator. He admitted that his officers did not know what they were doing and, quote: 'It's all an act really'. He gave me a piece of paper to produce to police officers in the future, which he said would stop my harrassment. When I attempted to drive off I noticed that the door lock on the vehicle no longer worked, so I presume the door had been forced open by the police.

29/2/80

Evening, approximately 9pm. My girlfriend was driving myself and a few friends out for a drink in my car. In Dunmow a police car pulled in front of us as we were parking. PC1723 Bird started questioning us. I informed him that I had spent three hours that morning in a police cell and was thoroughly fed up with this constant harassment by the police. PC Bird then made a rude and offensive remark to me, in front of my friends.

Note that there was no radio equipment in the vehicle.

3/3/80

At 8.15am I was chatting happily to Brian G4CTS again, and as I joined the M11 I was boxed in by two police cars, one in front and one to the rear. PC1238 demanded to know what my callsign was, straight off. Four police officers then kept shouting at me all at once and acting annoyed when I didn't reply to one of them. I am afraid I cannot answer four people at one time. When I asked why he wanted to know the callsign PC1238 threatened to arrest me for 'failing to supply a police officer with a callsign'. I then showed him the paper supplied by the collator at Harlow police station. PC1238 (who refused to give his name) informed me that the paper was not worth having, since I could have installed illegal equipment since 29/2/80. It is interesting to note that during my four officer interrogation none of them asked me for my name or address. After fifteen minutes of interrogation about my radio equipment (despite my protests that they were not authorised to detain me for this purpose, or to examine my station), and being thoroughly frightened about being detained in police cells again, I was 'released' and then followed down the M11 by a police car.

Again late for work. I made a formal complaint to my MP about my harassment, and later to the police.

27/11/80

The Home Office wrote to me confirming that section 159 of the Road Traffic Act 1972 'does not, however, empower the police to detain a vehicle once it has been stopped solely in order to establish whether or not it contains unauthorised radio equipment'.

10/12/80

The Home Office confirmed that: 'A police officer is not an 'authorised person' for the purposes of the amateur radio licence'.

14/1/81

I received, after nearly a year, a reply from the police complaints board. Highlights of this letter are as follows: 'police officers in the Harlow area had been given information about police powers in connection with CB radio, part of which was misleading . . . He (the Deputy Chief Constable) accepts, however, that these frequent stops, and your arrest on one of those occasions, reflect a lack of knowledge of this area of the law at the time . . . The Deputy Chief Constable regrets the inconvenience caused to you . . . it turned out the officers were acting misguidedly . . .'

Re PC Bird: 'The Deputy Chief Constable apologises, however, for the objectionable remark apparently made by the officer. He intends to have the officer strongly advised about his future conduct . . . The Board can appreciate that you were justifiably annoyed at the frequency with which you were stopped, and particularly inconvenienced by your arrest.'

28/1/81

I received a letter from the Deputy Chief Constable, in which he describes my comments as contentious.

9/2/81

In another letter the police complaints board admitted to 'the lack of police knowledge of this subject at the time . . .' and said that 'neither the Board nor the Deputy Chief Constable were suggesting that there is any obligation to carry your licence with you'. The letter also stated that: 'Police do not have the authority to detain vehicles for inspection of radio equipment'.

Easter 1981

A friend was helping out at a Boys Brigade meeting. PC Bedford made careless and unwarranted remarks to members of the public about me.

28/5/81

The Deputy Chief Constable agreed that PC Bedford committed the above disciplinary offence.

7/8/81

In a further letter from the Deputy Chief Constable he said: 'I propose to enter into no further direct correspondence with you on this issue'.

I apologise for taking only bits out of letters, rather than print out every letter in full. This is obviously impossible, since my file on the above fills a large folder. I have tried not to take any sentence out of its context.

I note with interest that if you are up in court lack of knowledge of the law is no defence, but the police have used their ignorance of the law as their defence. My biggest objection, however, is the lack of police apology for harassment. They just will not write it down, and use vague words like 'inconvenience', 'justifiably annoyed' etc.

Another facet of the above that gets right up my nose is that I have to waste hours and hours in a police cell or on the roads answering ignorant questions from the police who have no right to detain me, but the police will not agree to meet me or write an apology that will satisfy me.

Just think what would have happened if I had illegally detained a police officer on a non-existent offence for three hours, and while detaining him I had forced my way into his police car, made objectionable remarks to him and operated a radio system that I held no licence for.

Can't understand

Readers may be interested to note that during 1982 I was stopped by a police officer who was on foot. He had just received information that he was urgently required on the other side of town (he had no radio with him) and required me to transport him to the incident. He showed no interest at all when I wished to discuss with him the last time I tried to help out the police, and ended up locked in a cell. He couldn't understand my attitude to the police at that time. Can you?.

Incidentally, I now operate mobile only very rarely. I couldn't take all the hassle again. Was it merely 'inconvenience' or was it police harassment? I know what I think it was, what do you think? It's amazing how everything stopped when I complained to my MP about it all.

And the RSGB...

As a finale, the RSGB requested all information on the matter and it was forwarded to them 'as it happened'. They promised to raise questions in the Home Office and get a complete apology. They did completely and utterly nothing. When asked why nothing had been done Mr Evans at the RSGB said, 'The police have such wide ranging powers under the prevention of terrorism acts that nothing can be done in this case'. The police never mentioned terrorism. Words fail me.

Opinionated?

Let us know your views, problems, doubts, prejudices, experiences or whatever.

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GOING 10 METRE MOBILE

All you need to know about getting started in this mode

by John Petters G3YPZ

The choice of which band to operate mobile on is dependent on a number of different factors, not least the economical ones. With the price of both HF and VHF gear being well into three figures, and the risk of rigs being stolen, many amateurs today are looking towards a cheap and effective way of radiating a mobile signal.

The low cost of FM CB rigs either modified or unmodified, coupled with the abundant supply of cheap aerials, makes the 10m band an ideal proposition. In this article I will attempt to outline the benefits as well as the snags and pitfalls of 10m mobileering.

Getting on the air

Having obtained a working rig, it is worth pausing to examine its performance before installing it in the car. Most people on 10FM are using low deviation and receivers with 8KHz IF filters, so a check to make sure that the transceiver is spot on the correct channel is well worthwhile. If the rig *is* off channel, considerable distortion will be apparent on both received and transmitted signals with interference to and from the adjacent frequencies.

Next it is worth checking the deviation — if it is high, then the modulation will spread too far either side of the channel causing QRM to other operators. Speech peaks will also close the squelch on the receiver at the other end. The correct method of setting the deviation is with the appropriate deviation meter, but for the impoverished try shouting the word *'four'* into the mic and see if you close your contact's squelch. If the squelch closes then the peak deviation is too high and should be backed off.

Some rigs have a separate mic gain and deviation control — in this case best results will be obtained with full mic gain, which should give a good punchy modulated signal. On rigs where the mic gain control alters the deviation, it is worth putting a small Vogad compressor circuit in the rig to maintain a constant audio level without over-deviating.

One of the biggest failings on 10FM is poor audio. The average CB rig and its microphone deliver a very strangled restricted signal, usually under-deviated. This results in a very severe limitation of usable range. The LCL and DNT rigs seem to suffer particularly from this problem. A variety of different modifications have appeared from time to time, but I would recommend the use of the old Pye Ranger or Cambridge mic insert, which gives a high output with a very punchy crisp response.

In fact, I have used this type of mic insert on SSB, AM and FM rigs with extremely good results. The name of the game is to communicate, so it is no use whatsoever having a BBC quality signal when you are going to be working under noisy and unsatisfactory conditions.

Worth checking

It is certainly worth checking the sensitivity of the receiver, and upgrading the RF amp and mixer on rigs where the performance is inadequate. A sensitivity of about 0.2 microvolts for 20dB of quieting should be the aim. If the rig will not produce this then there is a good chance that you will have stations calling that will be inaudible.

It is better to upgrade the front end of the rig rather than use an external pre-amp, unless you are using a multi-band rig, all of which are deaf on 10m. The use of a pre-amp in this case saves having to delve into a highly expensive piece of gear and avoiding possible invalidation of the manufacturers' guarantee. The transmitter should be checked to ensure that the required power and frequency are appearing at the output.

Installing the rig

There are several different ways of mounting a mobile radio into a vehicle. The position with respect to safety and ease of operation should be of paramount importance. The radio should be within easy grasp of the driver so as to avoid having to lean across the passenger seat to gain access to the controls. The use of a good boom mic is also advisable from a safety point of view, but choose one with the correct response.

If the rig is to be a permanent fixture (thieves and vandals permitting) it should be mounted so that the case has a good solid earth return. This is sometimes difficult with today's tendencies toward plastic interiors. A good earth is important from the point of keeping ignition interference out. If the rig is to be removable, then one of the CB type slide mounts will do a good job, but again in the interests of noise and indeed, VSWR, it is advisable to connect the antenna directly into the back of the rig avoiding the copper contacts on the slide mount itself.

An extension speaker is a good idea as most rigs have the in-built speaker in the bottom of the case, which fires the sound downwards, making readability difficult under noisy conditions.

Electrical interference

Frequencies around 30MHz seem very prone to picking up all manner of man-made noises — far more than the VHF bands. The most irksome interference is that which is caused by the electrical system of the vehicle. This manifests itself from a variety of different sources, the most common being the HT ignition system, the generating system or one of the motors used to drive the windscreen wipers or heater fan, etc.

On an FM receiver the noise is not apparent until the squelch is opened by a carrier. Noise pulses can be seen as an S-meter reading. Depending on the amplitude of the carrier and the noise, and the effectiveness of the limiter, this interfering signal can modulate the incoming carrier, making it appear to be weak and scratchy. Ignition or generator noise will vary in intensity and speed with the engine revs.

Assuming that no other electrical apparatus is switched on, a simple test may be carried out to find which of the two noise sources is present. The engine should be revved and the S-meter reading observed. Switch off the ignition, thus removing the supply to the coil, and see if the S-meter reading diminishes. If it does, then the noise is being generated by the HT ignition system. If the reading persists then the generator/alternator is the culprit.

Curing ignition interference

Defeating the vehicular QRM is an art in itself, with a wide range of techniques and approaches. Much trouble can be avoided by proper installation in the first instance, rather than a quick 'bodge the rig into the cigar lighter' technique.

First and foremost, ensure that the rig is fed with a hefty coaxial supply lead (UR67 or similar) directly onto the battery (via a fuse, of course). This will prevent RF energy from the HT leads being induced into the supply line of the radio. The antenna base and feeder braid must be dc earthed to car body; this can be a particular problem with gutter-mount bases, and can wreak havoc with VSWR measurements.

Suppressed HT leads should be used. This should drastically reduce the problem. For really stubborn vehicles it is sometimes necessary to screen the HT leads with UR67 braiding, earthing both ends to the engine block. Metal shields should be placed over the plug ends and the distributor cap and the ignition coil should be encased in a tin can. The screening cans should then be earthed to the engine block.

A metal shield should also be fitted around the body of the distributor; this can be made from thin copper foil and formed to fit the contours of the distributor. This should then be grounded. The LT leads from the coil should be taken from the screen via feedthrough capacitors.

The car bonnet should be bonded to the body in several places by thick coaxial braid. The engine and exhaust pipe should be treated the same way. In some cases the exhaust pipe needs to be bonded at frequent intervals throughout its length, as this is usually a nice resonant antenna on 10m. By this time, if you are lucky, you will have banished the curse of the noisy ignition.

If not, then further bonding of the chassis and body of the vehicle, the doors, boot, windows etc, may be needed (see *Table 1*). On a Renault 4, the gearstick needs earthing to the engine as this can radiate quite effectively. Some dealers can also supply VHF suppressed plugs which may be of some considerable help.

Table 1 shows the areas of the vehicle that require bonding to the chassis with thick coaxial braid.

Generator/alternator noise

Interference from an alternator can be in the form of a whine which is audible in the receiver and is radiated on the transmitted signal, or, in the case of a generator, excessive sparks from the brushes/armature which will sound similar to ignition interference. A feedthrough capacitor in the order of 0.01 microfarads should be fitted on the generator casing and used to feed the armature connection. Disc ceramic capacitors soldered directly onto the brush connections are also effective in by-passing this type of interference. In really stubborn cases, a parallel tuned L/C trap for 29MHz could be placed in series with the armature lead, hence rejecting RF noise at the receiver operating frequency.

Voltage regulators can also cause problems. Feedthrough capacitors can again be mounted on the battery and armature terminals, but the field winding should have a capacitor and resistor connected in series to earth. The resistor is used to prevent damage to the generator in the event of the by-pass capacitor going short circuit. If noise still persists, then the field lead from the generator should also be screened, with the braid being grounded. Finally, ensure that the generator/alternator is properly bonded to the engine block.

Instrument noise

Interference from wiper-motors and heater-fans can usually be cured by decoupling the supply leads with disc ceramic capacitors. Again, in stubborn cases, decoupling may have to be applied at the brush holders inside the motor, or the tuned series trap method may need to be incorporated. Interference from the fuel or heater gauges can usually be cured by decoupling at the sender elements.

10m mobile aerials

The range of antennae for 10m is considerable, and some caution is required before making the final choice. There are a variety of different mounting systems available, from gutter mounts to magnetic mounts as well as the proper 'drill a hole through the body' type. The latter is by far the best from an electrical point of view, as there is a permanent and definite chassis connection; however, not everybody likes the idea of hacking a great hole in a nice shiny new car!

A mag mount is the least desirable choice as there is no dc ground on this system. Mag mount antennae also have the distinct possibility of parting company with the vehicle at high speeds.

The quality of gutter mount construction varies from excellent to abysmal, and care should be exercised in examining the mechanical construction before parting with the cash. After mounting the base, check the dc resistance to chassis to ensure that the base is effectively earthed.

The position of the aerial on the car body can seriously affect the efficiency of the system. The ideal is in the middle of the roof, thus giving a reasonably uniform groundplane. In practice, it is often only practical to gutter mount on the side of the car. This will give a distorted radiation pattern, with the effect of gain in the direction of the largest groundplane area. Mounting the aerial on the front wing or the boot of the car will have a very directive effect.

Areas to be bonded

Engine block to frame	Bonnet to chassis
Air filter assembly to engine block	Front and rear bumpers to chassis
Exhaust manifold and pipe to engine block and chassis	Boot lid to chassis
Battery ground terminal to chassis	Doors to chassis
Steering column to chassis	Sun roof to chassis

Best results

Of the many different types of antenna available, the helically loaded ⅝ wave has proven to give the best results. The Rebel 500 in its 5ft version was used by G3YPZ for many years until a local vandal removed it last month!!! The DX27 ⅝ wave, the Fire Stick and numerous others of that type of construction, should give good performance.

A full size ¼ wave whip is the easiest antenna to match, but its physical size is a bit prohibitive, and the results are not up to the standard of a good helical ⅝ wave, with its lower angle of radiation. Such loaded ¼ waves as the DV27, the Oscar etc will perform adequately, but if a loaded antenna is to be used then it is better to use a centre loaded or top loaded type in preference to a base loaded whip. Again the mechanical construction should be a prime consideration.

As in the case of base station aerials the use of multi-band aerials for 10m mobile use will result in a very poor compromise. The aim is to radiate a good low angle signal with maximum efficiency.

All 27MHz aerials will need pruning to resonance for 10m operation. First steps first, check the feeder run into a dummy load to ensure that 1:1 SWR is present. Next, connect the feeder to the antenna and measure the SWR at the lowest operating frequency. The antenna should then be cut at not more than ½ inch at a time, noting the SWR reading each time. If the aerial is for use on the FM portion of the band only, then it should be cut so that the minimum SWR is centred on 29.600MHz.

If full band coverage is required, then a resonant frequency of around 28.800MHz should give adequate performance throughout the band. Special care should be taken when trimming helically wound aerials as there can be many turns of wire in each ½ inch of antenna. It is better with this type of aerial to unwind the helix a few turns at a time, checking the SWR after each alteration.

Working the band

For the amateur used to working on 2m, the transition to LF should not cause too many problems. FM activity on 10m is channelised with a 10KHz spacing. The calling channel is 29.600MHz which at peak operating times should be vacated as soon as a contact is established. The favoured QSY channels are between 29.550 and 29.690MHz. Frequencies between 29.350 and 29.550 should be kept clear as these are allocated to the satellite service.

Some degree of patience may be required as activity, although firmly on the increase, is by no means as high as 2m. Don't get disillusioned if you do not get a reply to every call: just keep trying, because if everybody gave up and went back to 2m and the repeaters, there would never be any activity on any other band.

Range and power

The range of a mobile station is dependent on a number of factors – transmitter power, receiver sensitivity, aerial, background noise as well as terrain. Assuming a transmitter power of 4 watts into ⅝ wave helical whip in town, the range should be in the region of about 15 miles. Increasing the power to 25 watts will give a correspondingly greater coverage. If 100 watts are used then distances of up to 40 miles should be possible.

Unlike 2m, the 29MHz band does not suffer from excessive mobile flutter, the fading is much slower and similar to that experienced with Top Band mobile operating. The effects of buildings and hilly terrain on 10m signals is noticeably less drastic than on 2m. In many cases the simplex mobile to mobile range on 10m can be as great as the 2m range via a repeater.

The DX aspect

So far I have only discussed the flat space wave or direct wave range. 10m also offers the benefits of tropo, sporadic-E and, of course, F2 ionospheric propagation. This opens up the possibilities of working not only considerable distances in the UK, but inter-Europe via E and worldwide via F2.

Table 2 shows a list of country prefixes worked by G3YPZ/M since 1979. The equipment used was a Unicom UX502 10FM transceiver with power varying from 1 watt output to 100 watts. The antennae used were ¼ wave full size whip, 4ft centre loaded gutter mount whip and the Rebel 500 helical ⅝ wave. In addition to the many simplex DX contacts, it is often possible to work through the American and European repeaters when conditions are good. I will however point out that the chances of working F2 DX for the next few years are slight, due to the declining sunspot conditions. Sporadic-E will be a regular occurrence even in the minimum years, but mainly during the summer months.

Country prefixes worked by G3YPZ/M

CN8, CT1, 2, 3	OE, OH, OZ
DJ, DL, DF, DA,	PY, PP
EA, EA8	RA, RQ, RL
EL8	SM, SV
F, FY7	UA, UB
G, GM	VE1, 2, 3, 6
HA, HG, HB9, HH7	VK6, VK4
I, IT	W1-0
JA, JH, JE	YU, YZ
KA, KG4, K1-0	ZS
LA, LU	4X, 4Z
N	

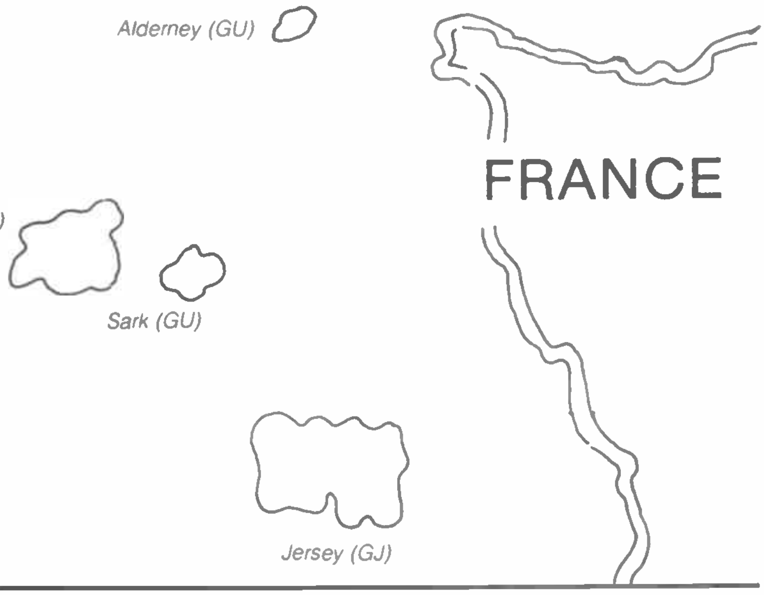
How much will it cost?

On current prices 10m FM is by far the cheapest band to get on. Rigs are available – fully modified – from around £40 with an aerial costing as little as a few quid. Most CB dealers carry a range of power amplifiers ranging from 25-100 watts with prices starting around £15. Gutter mounts for aerials can be obtained for around a fiver, but the best thing is to shop around for the best deal.

Clearly, though, it should be possible to get on the band for a total outlay of around £50, which in this day and age is next to nothing. A comparable 2m system would be approaching £200.

In the following article I will demonstrate the differences between 10m, 4m and 2m mobile operation under controlled conditions.

CW CONTESTING IN THE CHANNEL ISLANDS



NIGEL CAWTHORNE G3TXF

There's no doubt about it! The weather does go in cycles. Four years running a group of CW contest enthusiasts have operated the CQ Worldwide CW Contest from the Channel Islands and every year there have been gales and storms.

With the CQ WW CW Contest being on the last weekend in November, there is a greater likelihood of storms then than at many other times of the year. But nevertheless the fact that this CW contest suffered severe storms for four years running over the same weekend seems more than just coincidence!

The rules and background to the CQ Worldwide Contests were described in the October '84 edition of *Amateur Radio*, and as explained, the scoring in the contest depends not only on the numbers of stations worked but also the number of CQ zone and country multipliers worked. Being in a rare country, even with a relatively low signal, can be a lot of operating fun during the CQ WW Contests.

Alderney '81 and '82

In 1981, Roger G3SXW and the writer operated from Alderney, the northernmost part of the Channel Islands, using the call GU3SXW. With there being no winter boat service to Alderney we had to fly in with all the gear. For this first trip we took two complete HF stations as well as a simple tri-band HF dipole and separate dipoles for 40, 80 and 160m.

Alderney is one of the smaller Channel Islands, being about 3 miles long and 1 mile wide. Any QTH on the island is never far from the sea. The Belle Vue Hotel made an ideal QTH. It not only had wide views of the sea and an excellent HF take-off, but also had a large flat roof.

The Belle Vue Hotel was our CQ WW CW Contest QTH for two years running. In 1982, the same team, but now joined by Ian G3WVG, returned to the same Alderney location. For the 1982 GU3TXF entry we used a tri-band beam on the roof of the hotel, which was a great improvement over the tri-band dipole. The beam helped improve our performance over the previous year's, but there were still problems with the LF antennae.

Although an ideal QTH for the HF bands, for the LF bands this location had one major drawback and that was the lack of space for long antennae. Also there were major interaction problems between antennae for different bands, which made spotting multipliers impossible on some bands.

Another disadvantage with Alderney was the need to take everything by air. The excess baggage charge became a major cost of the trip. In 1982, the three operators checked in at Southampton airport with 250Kg of luggage!

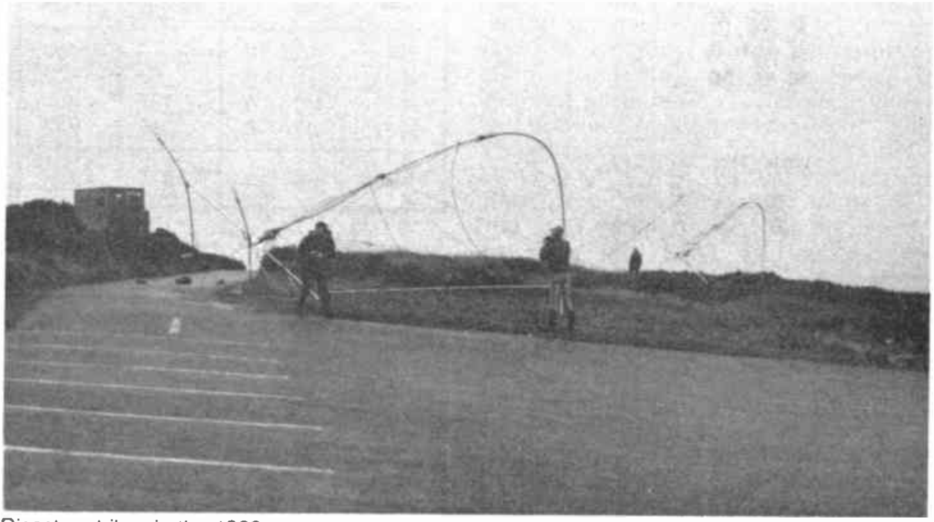
So, after two years of operating from Alderney, for the 1983 CQ WW Contest it was decided to try a different approach. The Channel Islands contain two DXCC multipliers: Jersey (GJ) and Guernsey and Dependencies (GU). For 1983 we would go for a change of prefix and country – we planned on operating from Jersey.

Jersey '83

Planning for the first Jersey visit started several months ahead. Operating from a totally unknown site/hotel always has its risks (will the hotel manager let us put up antennae? Will there be TVI problems?). On Alderney we had been

Ian G3WVG prepares one of the masts in Jersey able to clamber over the hotel roof as much as we needed and there had been no TVI problems.

Fortuitously, during the autumn prior to the 1983 Contest, Roger G3SXW was visiting Guernsey and was able to make a hop over to Jersey for a reconnaissance of likely sites. On this preliminary visit Roger was met and greatly assisted by Bert GJ2LU, who already had a site in mind for us: Corbiére on the South-West tip of Jersey. It was an excellent choice. The take-off was even better than Alderney and there was plenty of open space for antennae next to the hotel. The first operation from Jersey was to be as GJ3SXW during the 1983 CQ WW CW Contest.



Disaster strikes in the 1983 contest

Planning

Having found a good site on Jersey, we immediately planned on much better antennae than we had used in previous years from Alderney. As we would be travelling by car and ferry rather than by plane, the weight restriction problems that we had had in previous years did not apply. We could take everything that we could get into the van! For Jersey, we were planning bigger things, and especially bigger antennae!

For the 1983 operation, the team was joined by Dennis G3MXJ. Dennis had had plenty of experience putting up masts in all sorts of locations and was a veteran of the record breaking contest expeditions to Guernsey made some years earlier as GC4DAA and GU4DAA.

With the extra ground space available, we planned on two HF beams on 40ft masts. Two beams would give the flexibility required to be able to run QSOs on one band while searching for multipliers on others. Planning meetings were held months before the contest and detailed lists of all the items we would need to take were drawn up. Scaffold poles were ordered from the local hire company for delivery at the hotel on the morning of our arrival.

The weather during the week before the 1983 contest weekend was excellent: bright sunshine and clear blue skies. What could be better for putting up antennae at a cliff top QTH! We had allowed three full days before the contest for antenna work. Heavy stakes had to be hammered into the rocky ground. We were expecting that it would be windy at some time during the contest, so care was taken to make sure that the mast stakes were firmly in the ground. Getting the stakes into the ground was a major problem because just below the top-soil there was solid rock. Dennis G3MXJ spent several hours bashing with a mallet to find secure locations for the sets of stakes that were needed to hold up the 40ft masts.

Ian G3WVG operating the main station

By Thursday evening both beams were up and working and the LF antennae had been installed. The stations were set up in one room in the hotel and by early Friday everything was ready for the contest, which would start at midnight. The afternoon was spent away from the station in St Helier and in the evening we met Bert GJ2LU for a relaxing evening before the contest.

CQ Worldwide Contests start at 0000z on the Saturday morning and run for 48 hours to midnight on the Sunday. Just before the contest a few final preparations were made to the checklogs and other essential operating records. At 0000z the first contest CQ went out on 40m, and GJ3SXW was off to a flying start.

During Friday the wind off the sea had begun to get up, but the masts with their three levels of guying looked solid and secure in the wind. There was just some movement in the beam at the top, as it exercised the play in the rotator.

Saturday morning brought the first openings on the HF bands and showed that our planning for two HF beams had been worth it. One station ran pile-ups of stations after the GJ multiplier, while the spotting station trawled the other bands picking up valuable multiplier contacts.

During Saturday we tracked QSO and multiplier progress on an hourly basis against the previous year's performance (GU3TXF) and found that we were well ahead. Things were going well.

Declining sunspot numbers meant that the HF bands did not produce the same openings to the US as we had had in previous years. Nevertheless QSO rates of up to 160 an hour were being run with the USA on 15m. In previous years 10m had been the main US pile up band, but we will have to wait until the next sunspot cycle before such 10m pile ups return.

Storms

By 1900z the HF bands were getting quiet. The main station was now on 40m, with the spotting stations hunting for multipliers on 20m and the LF bands.

Outside, the wind had been getting stronger throughout Saturday and windows were rattling. Being perched right on top of the cliff, the hotel received the full force of the winds straight off the sea. By early evening the weather had turned really nasty. It was now blowing a strong gale. The masts still looked solid in the wind. The guys had all been checked and the stakes were still firmly in the ground.

At about 1930z the pile up stopped coming on 40m. Several more CQs, but no replies. The band still sounded hopping but GJ3SXW was not getting through! SWR was showing 5:1. Something must be wrong!

Once outside we could see what had happened. There had been a powerful gust which had blown down both masts in the same moment. No wonder we weren't getting out on 40m: the antenna was on the ground! All the antennae were down! The two beams had taken nose-dives into the rocky ground and the LF wire antennae were a floppy tangled mess! Despair and GJ3SXW goes QRT for 15 hours!

Early Sunday morning we untangled the wires and disconnected the buckled beams. They were not as badly damaged as we had first thought. One beam was reassembled and put onto a post only 6ft high pointing out to sea towards the US. It still worked like a bomb!

The LF wire antennae were tied to any convenient point and GJ3SXW was back on the air again on all bands, but with a somewhat reduced signal and operating capability.

We had learnt what damage the weather can do to antennae! A single hurricane force 12 gust had done it all. The masts withstood the gales, but that single hurricane gust was the final blow to the fine pair of HF beams at GJ3SXW! Despite the loss of so much operating time, we still clocked up some 2,000 QSOs.

CQ WORLDWIDE CW CONTESTING FROM THE CHANNEL ISLANDS SUMMARY OF QSO TOTALS MADE PER BAND

Year	Call	160m	80m	40m	20m	15m	10m	Total
1981	GU3SXW	–	482	521	486	772	870	3,131
1982	GU3TXF	69	507	513	523	762	951	3,325
1983	GJ3SXW	127	400	511	602	638	138	2,416
1984	GJ0AAA	220	713	843	758	522	5	3,061
Totals		416	2,102	2,388	2,369	2,694	1,964	11,933

Jersey '84

For 1984 the philosophy was to be different. It was 'get on the air and stay on the air for the whole contest' whatever the weather. Antennae were planned accordingly. For this year it was to be a single beam at 20ft, and two masts for the LF antennae. Guyed masts carrying simple wire antennae present much less resistance to the wind than a guyed mast with triband beam and rotator on top!

After the 1983 disaster, we thought that we had seen the worst possible weather on Jersey. In 1984 we were to be proved wrong!

This year the storm started on the Friday just before the contest. We had all three masts up by then. Two 40ft masts for LF wire antennae and a tiny 20ft mast for the beam. At around 1900z on the Friday evening, the wind again got up to hurricane gusts as it had done the year before. But this year it was not just one gust, but several. The 20ft mast with the beam stood solid, even though the beam elements were being blown bow-shaped.

One of the 40ft masts partially collapsed before the contest started. The first hour of the CQ WW CW Contest this year was spent not with all operators quietly relaxed in the shack but with G3WVG and G3TXF out in the storm on the cliff top rebuilding the 160m and 40m antennae, leaving G3SXW in the shack to work the pile-up on 80m!

The weather this year was worse, but its timing was better! The worst of the storm was before the contest, so that as the contest progressed things got better rather than worse.

Bert GJ2LU and Frank GJ4HSW had driven out from St Helier on the Friday evening before the contest to take a look at the station, only to find that the storm had breached the sea-wall in St Helier, many of the streets were flooded and that many roads on the island were closed. As they reached the hotel, there were police announcements on the TV advising Jersey people to stay indoors as roads were being blocked by falling trees in the storm.

Described in the local paper as 'the worst storm on the island since 1967', it just had to be the weekend of the 1984 CQ WW CW Contest!

New call – new prefix

Previous CQ WW CW Contest operations from the Channel Islands had been with individual callsigns (eg GJ3SXW and GU3TXF). The imminent arrival of the new G0 series of callsigns was seen as an opportunity to book a suitable club call for contest use. In 1983 a request was sent to reserve the callsign G0AAA for the '3 As Contest Group'.

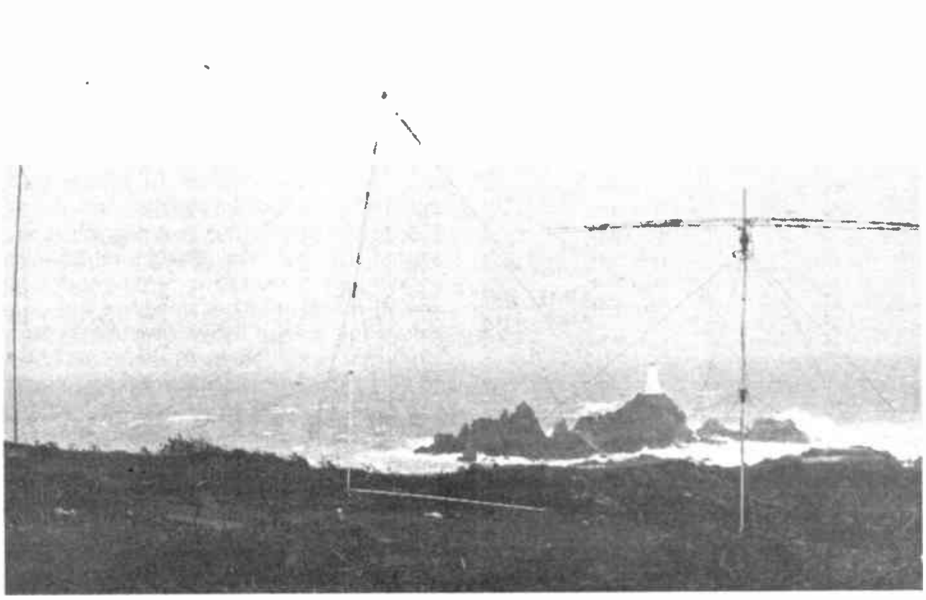
During the year the rate of issue of new calls was followed with keen interest, in the hope that the club call would be issued in time for the Jersey trip. Just two weeks prior to leaving for Jersey, the '3 As Contest Group' was issued with their call, G0AAA.

The first CQ by GJ0AAA at the beginning of the 1984 CQ WW CW Contest was the very first with the new UK prefix GJ0. The new prefix added interest to the contest operation. The callsign is long on CW, but was distinctive because of the new prefix. To some operators it was also confusing. Some tried to turn it into DJ0AAA or even G10AAA, probably thinking these look less strange than GJ0AAA!

As planned, and despite all that the Channel Islands weather could throw at us, GJ0AAA did stay on the air continuously during the 48 hours of contest and netted 3060 QSOs. QSL via G3TXF.

If you plan to visit the Channel Islands do not forget to drop a line to the local telecommunications board to advise them of your operating dates before you go and also to make contact with the local club. You'll receive a warm welcome even though it might be blowing a gale outside!

Corbiére lighthouse: backdrop to the 1983 & 1984 contests



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2 5mm Chassis Socket	0.10	10 80p
3 5mm Chassis Socket	0.10	10/1.20
2 pin 1/4in Mono Chassis Socket	0.14	10/1.75
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AC128	0.30
AC128K	0.34
AC132	0.55
AC141	0.26
AC141K	0.40
AC142	0.26
AC142K	0.45
AC151	0.45
AC152	0.45
AC176	0.28
AC176K	0.46
AC187	0.26
AC187K	0.40
AC188	0.28
AC188K	0.40
ACY40	0.88
AD142	1.10
AD143	1.10
AD140	0.90
AD161	0.42
AD162	0.42
AD161/162	0.95
AF106	0.48
AF114	2.10
AF115	2.10
AF116	2.10
AF117	2.10
AF118	0.85
AF121	0.62
AF124	0.48
AF125	0.48
AF126	0.48
AF127	0.48
AF139	0.68
AF178	0.68
AF239	0.68
AF279S	0.75
AL100	2.50
AL102	1.88
AL113	2.20
ASY80	1.75
AU110	1.40
AY102	4.32
BA102	0.34
BA110	0.67
BA121	0.40
BA129	0.38
BA148	0.16
BA154	0.08
BA155	0.10
BA156	0.08
BA157	0.28
BA164	0.14
BB104B	0.52
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12

Type	Price (£)
BC108	0.10
A B or C	0.12
BC113	0.14
BC114	0.12
BC115	0.12
BC116	0.15
BC117	0.22
BC118	0.17
BC119	0.30
BC125	0.12
BC140	0.28
BC141	0.42
BC142	0.30
BC143	0.30
BC147	0.08
A or B	0.10
BC148	0.08
A or B	0.10
BC149	0.09
BC157	0.10
BC158	0.10
BC159	0.10
BC160	0.30
BC161	0.30
BC168B	0.12
BC169C	0.10
BC170	0.14
BC170B	0.12
BC171	0.10
BC171	0.10
A or B	0.08
BC172	0.08
A or B	0.12
BC177	0.20
BC178A	0.22
BC182	0.09
A B or C	0.09
BC182L	0.09
A B or C	0.09
BC183	0.09
A B or C	0.10
BC183L	0.08
A B or C	0.12
BC184L	0.10
A B or C	0.10
BC207	0.15
BC208	0.16
BC212	0.09
A B or C	0.10
BC212L	0.08
A B or C	0.10
BC213	0.09
A or B	0.10
BC213L	0.10
A or B	0.10
BC237	0.11
BC238	0.12
BC239C	0.14
BC251	0.12
A B or C	0.14
BC301	0.30

Type	Price (£)
BC302	0.32
BC303	0.32
BC307	0.10
BC308A	0.10
BC323	0.99
BC327	0.14
BC328	0.14
BC337	0.12
BC338	0.12
BC350	0.14
BC440	0.30
BC441	0.32
BC461	0.32
BC547	0.12
BC548	0.12
BC549	0.12
BC550	0.18
BC550C	0.18
BC557	0.12
BC558	0.12
BCX34	0.27
BCY70	0.15
BCY71	0.17
BCY72	0.18
BCZ10	1.68
BCZ11	1.45
BD124P	0.80
BD130Y	0.68
BD131	0.34
BD132	0.34
BD131/132	0.95
BD135	0.32
BD136	0.36
BD137	0.36
BD138	0.38
BD139	0.38
BD140	0.38
BD144	1.60
BD145	1.82
BD150A	0.51
BD159	0.65
BD160	1.65
BD165	0.45
BD175	0.60
BD182	1.00
BD183	1.10
BD184	1.20
BD201	0.72
BD202	0.87
BD204	0.80
BD222	0.80
BD225	0.86
BD232	0.45
BD233	0.60
BD234	0.62
BD235	0.63
BD236	0.63
BD237	0.65
BD238	0.56
BD241	0.60
BD243A	0.80

Type	Price (£)
BD244A	0.65
BD375	0.32
BD410	0.76
BD434	0.68
BD436	0.68
BD437	0.76
BD438	0.75
BD439	0.68
BD507	0.48
BD508	0.53
BD509	0.84
BD510	0.48
BD517	0.56
BD520	0.66
BD699	1.25
BD707	0.88
BDX18	2.35
BDX32	2.10
BF115	0.32
BF117	0.54
BF119	0.82
BF120	0.38
BF123	0.40
BF125	0.42
BF127	0.38
BF152	0.16
BF154	0.23
BF157	0.40
BF158	0.22
BF159	0.24
BF160	0.23
BF167	0.30
BF173	0.25
BF177	0.42
BF178	0.30
BF179	0.32
BF180	0.35
BF181	0.35
BF182	0.32
BF183	0.32
BF184	0.32
BF185	0.32
BF194	0.08
BF195	0.10
BF196	0.10
BF197	0.10
BF198	0.14
BF199	0.16
BF200	0.26
BF222	0.48
BF224	0.20
BF224J	0.16
BF240	0.20
BF241	0.20
BF244	0.26
BF244A	0.28
BF244C	0.24
BF245A	0.28
BF254	0.15
BF256	0.40
BF257	0.32

Type	Price (£)
BF258	0.30
BF259	0.32
BF262	0.30
BF263	0.30
BF270	0.30
BF271	0.26
BF273	0.18
BF274	0.32
BF323	0.92
BF324	0.26
BF337	0.26
BF338	0.26
BF355	0.42
BF363	0.82
BF367	0.24
BF371	0.27
BF422	0.38
BF450	0.38
BF457	0.33
BF458	0.36
BF459	0.44
BFR39	0.22
BFR40	0.22
BFR41	0.22
BFR51	0.30
BFR61	0.32
BFR62	0.28
BFR88	0.34
BFR90	1.72
BFT41	0.38
BFT43	0.38
BFW10	0.79
BFW44	0.76
BFX29	0.28
BFX30	0.30
BFX80	3.56
BFX84	0.26
BFX85	0.26
BFX86	0.26
BFX87	0.26
BFX89	0.65
BFY50	0.21
BFY51	0.21
BFY52	0.21
BFY57	0.40
BFY90	0.90
BFY90S	1.34
BR100	0.20
BR101	0.44
BR103	0.58
BRC4443	1.76
BRY39	0.38
BRY56	0.42
BRY61	0.86
BSS17	0.56
BSS27	0.92
BSX19	0.34
BSX20	0.34
BSX59	0.62
BSX76	0.29
BT100A/02	0.94

Type	Price (£)
BT101/300	1.15
BT101/500	1.25
BT102/300	1.35
BT102/500	1.65
BT106	1.50
BT108	1.30
BT109	1.18
BT116	1.25
BT119	3.62
BT120	3.60
BT121	3.02
BT138/600	1.30
BT151/560R	0.90
BT151/300R	1.15
BTY79/400R	2.80
BU100A	2.30
BU104	2.00
BU105	1.20
BU105/02	1.56
BU108	1.50
BU124	1.75
BU126	1.25
BU133	1.80
BU204	1.35
BU205	1.30
BU206	1.70
BU208	1.55
BU208A	1.63
BU208/02	2.05
BU326S	1.75
BU407	1.65
BU407D	1.80
BUX80	3.70
BUY20	1.75
BUY69A	2.60
BUY69B	1.98
BUY101	0.48
BY118	1.10
BY122	0.68
BY126	0.12
BY127	0.10
BY133	0.16
BY135	0.25
BY164	0.44
BY176	0.66
BY182	0.87
BY184	0.40
BY187	0.72
BY189	4.75
BY198	0.44
BY199	0.47
BY206	0.24
BY207	0.24
BY210/400	0.25
BY210/600	0.26
BY210/800	0.30
BY223	1.20
BY227	0.26
BY229	0.30
BY238	0.68
BYX10	0.24

Type	Price (£)
BYX36/150	0.22
BYX36/600	0.28
BYX48/300	0.72
BYX49/300	0.47
BYX55/350	0.29
BYX55/600	0.33
BYX71/600	1.18
BYZ12	0.42
C106D	0.80
E1222	0.40
E5024	0.30
GET872	0.48
ICT44	0.04
ITT2002	0.11
ME0402	0.20
ME0404/2	0.24
MEU21	0.60
MJ400	1.25
MJ2955	0.90
MJ3000	1.98
MJE240	0.60
MJE340	0.54
MJE370	0.88
MJE520	0.88
MJE2955	0.99
MJE3055	0.70
MPSLO1	0.28
OA47	0.10
OA90	0.08
OA91	0.09
OA95	0.18
OA200	0.06
OA202	0.15
OC25	2.10
OC26	1.70
OC28	1.50
OC29	2.47
OC35	1.75
OC36	1.75
OC42	0.72
OC42K	1.40
OC44	0.72
OC45	0.58
OC71	0.50
OC72	0.52
OC81	0.68
OC200	2.46
OC202	2.20
ORP12	0.85
R2008B	1.50
R2010B	1.52
SHG1 5	0.40
TAG1/100	1.40
TAG3/400	1.78
TIC44	0.40
TIC45	0.45
TIC46	0.48
TIC47	0.70
TIC106A	0.70
TIP30A	0.46
TIP31C	0.84

Type	Price (£)
TIP32	0.40
TIP32C	0.60
TIP33A	0.63
TIP34A	0.72
TIP41C	0.46
TIP42A	0.52
TIP47	0.60
TIP110	0.88
TIP2955	0.60
TIP3055	0.60
TIS43	0.32
TIS88	0.40
TIS90	0.25
TIS91	0.28
ZTX108	0.12
ZTX109	0.12
ZTX212	0.28
IN4001	0.05
IN4003	0.05
IN4004	0.06
IN4006	0.07
IN4007	0.05
IN4148	0.05
IN5400	0.12
IN5402	0.15
IN5405	0.16
IN5406	0.18
IN5408	0.20
IS920	0.08
2N697	0.55
2N706A	0.33
2N2904	0.28
2N2906	0.24
2N2926G	0.10
2N3053	0.22
2N3054	0.56
2N3055	0.45
2N3702	0.10
2N3704	0.10
2N3708	0.10
2N3772	1.90
2N3773	2.70
2N3904	0.16
2N3906	0.16
2N5294	0.48
2N6107	0.71
2N6126	0.68
2SB337	1.60
2SC1172Y	2.90
2SC1173Y	0.82
2SC1302	1.40
2SC1226	0.84
2SC1279	0.50
2SC1306	0.92
2SC1307	1.40
2SC1413A	2.70
2SC1444	1.45
2AC1449	0.63

BRIDGES

1 1/2A 50V	0.27
100V	0.28
200V	0.32
400V	0.40
600V	0.67
800V	0.58
2A 100V	0.52
200V	0.55
400V	0.61
600V	0.67
800V	0.70
6A 100V	0.66
200V	0.68
400V	0.74
600V	0.80
800V	0.86
10A 50V	2.20
100V	2.24
200V	2.35
400V	2.50
600V	3.50
25A 50V	2.05
100V	2.25
200V	2.40
400V	3.20
600V	3.95

PANEL METERS

FSD
60 x 46 x 35mm
0-50µA
0-100µA
0-500µA
0-1mA
0-5mA
0-10mA
0-50mA
0-100mA
0-500mA
0-1A
0-2A
0-25V
0-50V AC
0-300V AC
"S"
"VU"
ALL – £5.00

BRITISH TELECOM APPROVED PLUGS & SOCKETS

BT Plug and 4 core lead	£1.25
BT Plug only	65p
BT IPC Insertion tool	50p
BT Master Socket	£3.25
BT Secondary Socket	£2.25
BT 4 Core Cable 15p/M.	£12/100M Drum
BT Plugs 4-Way each 10/55	58p

ZENER DIODES

400mW Plastic 3V-75V 8p each 10/75p
1.3W Plastic 3V-200V 15p each 10/£1.40
1.5W Flange 4 7-47V £1.26 each
2.5W Plastic 7.5-75V 87p each
20W Stud 7.5-75V £1.31 each

INTEGRATED CIRCUITS (£) EACH

AN240P	3.42	SN76530P	1.40
AN214QQ	3.88	SN76533N	1.60
AN7150	2.90	SN76650N	1.05
CA3065	1.75	SN76660N	0.75
CA4031P	2.88	SN76666N	0.80
CA4102	3.30	STK015	6.50
CA4250	3.50	TA7108P	3.20
CA4400	3.07	TA7120P	3.20
CA4422	3.07	TA7129AP	3.65
LC7120	5.33	TA7130P	1.65
LC7130	5.26	TA7172P	1.80
LC7137	5.18	TA7193	5.50
LM380N	0.80	TA7172P	1.80
LM1303N	2.52	TA7176	5.50
HA1151P	3.12	TA7202P	4.18
MC1307P	1.85	TA7204P	1.86
MC1310P	1.85	TA7205AP	1.50
MC1312P	2.25	TA7208P	3.27
MC1327P	1.25	TA7210P	6.50
MC1330P	0.83	TA7222P	1.88
MC1349P	1.85	TA7223P	3.68
MC1350P	1.20	TA7227P	6.60
MC1351P	2.50	TA7310A	1.80
MC1352P	1.50	TA7609P	4.28
MC1357P	2.88	TA7611AP	2.88
MC1358P	1.30	TAA263	2.46
MC1496P	1.15	TAA310A	2.68
ML231B	2.10	TAA550	0.60
ML232B	2.10	TAA570	1.99
ML237B	2.30	TAA611A12	3.50
NE555	0.25	TAA611B12	2.85
C-mos 555	0.88	TAA630S	3.90
NE556	0.60	TAA661B	1.70
SAA1024	5.35	TAA700	2.80
SAA1025	8.40	TAA840	3.38
SAS560A	2.50	TAD100	2.80
SAS560S	1.85	FM FILTER	1.20
SAS570S	1.85	TBA120A	1.00
SAS580	2.85	AS, S, SA SB	1.20
SAS590	2.82	Q T, U UQ	1.32
SC9503P	1.10	TBA120B	1.30
SL432A	4.00	TBA231	1.45
SL901B	5.20	TBA281	2.65
SL917B	6.25	TBA395	1.20
SL1327Q	1.10	TBA480Q	1.50
SN76003N	2.44	TBA400	2.30
SN76013	1.90	TBA510	2.60
SN76023ND	2.90	TBA510Q	2.60
SN76033N	2.45	TBA520/Q	1.60
SN76110N	1.12	TBA530/Q	1.30
SN76115N	2.00	TBA540/Q	1.40
SN76131N	1.65	TBA550/Q	1.52
SN76226ND	1.80	TBA560C	1.70
SN76227N	1.10	TBA560CQ	1.40

TBA570	1.50
TBA641BX1	4.50
TBA673	2.40
TBA700	2.85
TBA750	2.80
TBA800	1.60
TBA810P	1.10
TBA810S	1.20
TBA820	1.20
TBA890	3.88
TBA920/Q	3.00
TBA940/2A	3.05
TBA970	4.05
TBA990	1.88
TCA160C	3.90
TCA270S	4.00
TCA270SA	4.02
TCA800	3.10
TCA940	1.90
TDA440	3.80
TDA1002	1.90
TDA1003A	5.50
TDA1004A	2.90
TDA1006A	2.40
TDA1035S	4.50
TDA1044	4.30
TDA1170S	3.00
TDA1190	3.50
TDA1200	2.98
TDA1270Q	3.70
TDA1327A	1.66
TDA1352A/B	1.56
TDA1412	1.30
TDA2002	2.60
TDA2020	4.60
TDA2030	2.78
TDA2140	5.90
TDA2521	4.10
TDA2523	3.50
TDA2530	2.70
TDA2540	3.80
TDA2541	3.80
TDA2560	3.80
TDA2571A	2.50
TDA2581	3.20
TDA2590	3.20
TDA2591	2.98
TDA2593	2.98
TDA2610	3.20
TDA2611A	1.94
TDA2641	2.90
TDA2680	3.40
TDA2690	3.50
TDA3950A/B	2.60
UPC554C	1.32
UPC557H	0.90
UPC566H	2.95
UP575C2	3.20
UPC1018C	1.10
UPC1025H	2.90
UPC1032H	0.90
UPC1156H	4.20
UPC1158H	0.76
UPC1163H	0.98
UPC1181H	1.60
UPC185H2	3.75
UPC1212C	1.30
UPC1230H	3.90
UPC1350C	3.90
UPC1367C	2.40
UPC1378H	4.40
UPC2002H	2.80

D CONNECTORS

	9 way	15 way	25 way
MALE			
Solder lugs	0.80	1.05	1 60
Angle pins	1 50	2 10	2 50
FEMALE			
Solder lugs	1.05	1 60	2 00
Angle pins	1 65	2 15	2 90
COVERS	0 85	0 80	0 80

VOLTAGE Regulators

78L05	30p
78L12	30p
78L15	30p
7805	55p
7812	55p
7815	55p
LM317K	3.50
LM317T	90p
LM340KC	£1

C-MOS

4000	24p	4021
4001	24p	4022
4002	25p	4023
4007	25p	4024
4011	24p	4025
4012	24p	4027
4013	56p	4028
4014	60p	4029
4015	60p	4030
4016	40p	4031
4017	60p	4033
4018	60p	4034
4020	85p	4035

74LS

LS00	28p
LS01	28p
LS02	28p
LS03	28p
LS03	32p
LS05	28p
LS08	28p
LS09	28p
LS10	28p
LS11	28p
LS12	28p
LS13	33p
LS14	58p
LS15	25p
LS20	28p
LS21	28p
LS22	28p
LS30	33p
LS32	28p
LS37	23p
LS74	38p
LS122	70p
LS138	45p
LS139	68p
LS151	75p
LS155	50p
LS157	45p
LS158	58p
LS160	60p
LS161	70p
LS162	72p
LS163	80p
LS166	1.95
LS170	1.75
LS244	1.00
LS245	2.00
LS257	73p
LS393	1.15

Type	Price (£)
2SC1507	0.63
2SC1678	1.06
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC1953	0.74
2SC1957	0.76

2SC1969	2.88
2SC2028	0.73
2SC2029	1.00
2SC2078	1.05
2SC2091	0.73
2SC2098	2.90
2SC2122A	3.20
2SC2166	1.20
2SC2314	0.80
2SC2335	1.50
2SC2749	2.70
2SC2752	0.30
2SD234	0.54
2SD348	3.30
2SD986	0.82
2SK134	3.80
2SK135	1.90
3N126	1.90
3N211	2.52
3SK45	0.76

ROTARY POTS

0.25W CARBON
LOG 4K7 - 2M2
IN 1K -2M2
32p ea 10 for £3
Any 100 for £27 50

VEROBOARD

2 1/4 x 3 3/4	[illegible]
2 1/4 x 5	1.00
2 1/4 x 17	3.25
3 3/4 x 17	1.05
3 3/4 x 5	1.15
3 3/4 x 17	4.10
4 3/4 x 17 3/4	4.95
Pkt of 100 pins	0.50
Spot face cutter	1.48
Pin insertion tool	1.80
Vero wiring pen & spool	3.50
DIP board	3.85
Vero Strip	1.25

IC SOCKETS D11 to D11

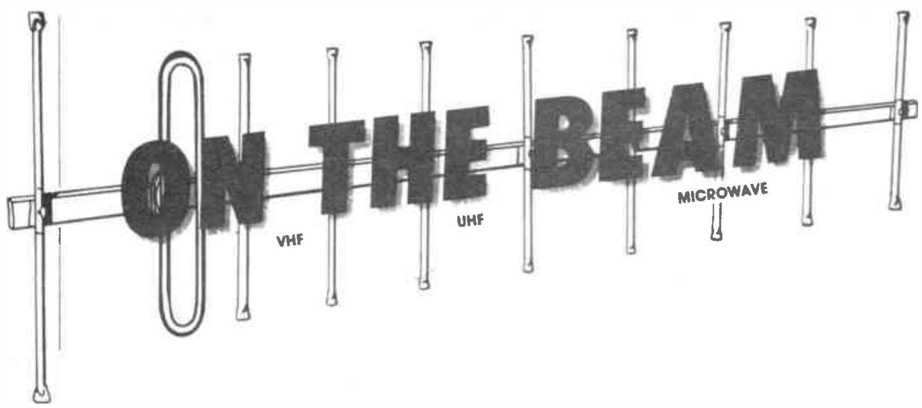
8 pin	[illegible]	0.70/10
14 pin	0.10	0.98/10
16 pin	0.11	1.00/10
18 pin	0.14	1.60/10
22 pin	0.21	1.95/10
24 pin	0.25	2.25/10
28 pin	0.30	2.75/10
40 pin	0.34	3.10/10

BNC 50R Plug
PL259 – Male Plug

MARCO TRADING (DEPT AR2)

The Maltings
High Street
Wem, Shropshire SY4 5EN
Tel: 0939 32763 Telex: 35565

ORDERING: All components are brand new and to full specification. Please add 45p postage/packing (unless otherwise specified) to all orders then add 15% VAT to the total. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome. (Do not forget to send for our 1985 catalogue - only 65p per copy. All orders despatched by return of mail NEW RETAIL 1000 sq.ft. shop now open Mon-Fri 9.00-5.00. Sat 9-12.00



News and comment from Glen Ross G8MWR

Class 'B' Morse

In the looking ahead spot in the January edition we remarked that class B Morse might be here a lot sooner than you expected. We were right! It was, in fact, announced just a couple of days too late to get the news into the January issue but, from the leaked information going the rounds, it was obvious that it could not be far away.

The news was finally released at the AGM of the RSGB and was received with cheers of delight. This is something that the RSGB has been working towards for a long time and anyone who has had to negotiate with government departments will realise that the only way is to tread very slowly; any hint of pressure and they close up like a clam.

They are also not to happy about any publicity concerning what is going on and in fact the 50MHz experiment was held up for a long time due to just that. Taking all things into account the RSGB must be congratulated on the outcome of the negotiations.

All amateurs

We have received a lot of correspondence about this matter. The two main points are as to how you go about getting authority and, because the letters are coming from the RSGB, is it for RSGB members only? The answer to the second one is that it is available to everyone on request. The method of obtaining the 'letter of variation' is to write to the RSGB, ' *Lambda House', Cranborne Rd, Potters Bar, EN6 3JW,* including two stamps to cover the cost of correspondence, and simply ask for the letter.

It will help them if you mark the envelope 'Class B Morse'. The letter does not come into effect until the 1st April but it is advisable to apply as soon as possible. A lot of people, when first hearing the news, refused to believe it simply because of the starting date.

Many people have asked why it is required to apply to the RSGB and why a notice was not published in the *London Gazette* to modify the existing licences. This is due to the fact that one of the main reasons for reluctance on the part of the authorities was the amount of paperwork that would be involved in issuing the letters. The RSGB neatly pulled the rug from under them by saying that they would look after that side of things.

As to why the letters are required in the first place, it is due to the fact that the powers that be have authorised the 'experiment' for a period of one year only and they wish to be able to judge the amount of interest that exists. This would obviously have been impossible if a general notice had been issued.

What now?

Whether we get this facility on a permanent basis depends on the amount of interest which class B operators produce. It is therefore *absolutely essential* even if you are not going to use Morse yourself that you apply for the permit to do so. Only if there is a deluge of applications can we be reasonably sure that class B Morse will be written into the licence in a year's time. It really is up to you.

At the moment there is no firm news of any restrictions on the use of Morse apart from the obvious one that you cannot go on the HF bands, and it seems likely that you will, in effect, have a class A licence restricted to frequencies above 144MHz.

It seems probable that, because there is going to be some lousy Morse flying around, you will have to send your callsign vocally at the start and finish of each period of sending, but this is a very small price to pay for the advantages which we are getting. As to any power or frequency restrictions which may be written in, we will let you know as soon as we get the news.

What next?

We got it right about the class B Morse, will we also be right with our forecast that crossband (HF to VHF) will soon be here? It is so obviously something that ought to be in the licence and it is very difficult to see how it could produce any problems. Perhaps next year?

Incidentally, while we are on this subject, let us restate the fact that it is just as illegal for a class A operator to work from, say, 28MHz to 50MHz as it is for a class B operator to work crossband from 144MHz. In both cases the operator is working to a band that he is not licensed to use. It is rather distressing to see some of the amateur radio press, including the RSGB's *Radio Communication*, not only condoning this practice but actually publishing the results obtained. I am not trying to be a killjoy, but if it is OK for one section to bend the rules then it should be a case of *all for one and one for all;* perhaps class B operators are more law abiding?

Microwave moves

As from January 1st the section of the 10GHz band recommended for wide band FM use has moved from 10.37 to 10.4GHz. In fact the vast majority of stations moved up immediately after the end of last year's contest season. The Microwave Society tuned up about fifty systems at the Leicester show and a similar number were returned at the RSGB's Sheffield microwave workshop event.

It seems as though some people in the southeast of the country are staying on 10.1GHz due to the fact that they get a lot of contacts into the continent and the feeling is that the continentals will stay put. In fact the current information seems to be that a lot of them are either going to move up or will have the facility to tune the whole band. It looks as though there may be a split of interest for a while and the best advice we can give to newcomers is to check what your local operators are doing. North of Watford you should have no trouble; 10.4GHz rules.

Talkback will be the same as last year, centred around 144.175MHz, which works well except for the odd occasion when there is a two metre contest on and then the 10GHz man gets the impression that he is trying to operate in two contests at once! The exact dates for this year's cumulatives are not yet known but they will be held each month from May to September.

The Microwave Society will be running contests to coincide with the European SHF/Microwave events and all dates will be announced as soon as they are available. There is a strong feeling that the present contest activity is no longer appropriate and that it would be much better to have regular activity days; for example, on the first Sunday of each month. Five events are no longer enough in view of the tremendous increase in activity on this band: in fact it is now very difficult to find a weekend when there is not some activity, to the extent that there were several stations operating portable in the Midlands on Boxing Day!

Certificates

Another item in last month's edition was the announcement of the new certificates and these have already brought in a lot of interest.

One comment that has been made by several people is that they like the idea of having to achieve several aims to get the wallpaper rather than just chase squares or whatever. This really is the whole point of the exercise, if you are just after new squares then the tendency is to keep listening until you hear a new one and then grab it. What this means in practice is that you tend to spend a lot of time listening instead of talking and you become one of the vast army of *licensed listeners* with which we are now blessed.

Once you have amassed a reasonable score your only real chance of adding more is to wait for the next big lift and so it goes on. We think that if you have to achieve certain standards in different areas to get the award then this is going to mean spending a lot of time on the air, after all some counties are not very radioactive and you may catch someone on in conditions that are far from 'lift'.

Another point that has received favourable comment is the fact that we all started on the 1st January this year. This seemed to us such an obvious idea that we had not realised how much comment we would get on this point. It means that it will be some time before anyone gets the award but at least we all start from scratch.

QSL cards must be available to confirm each contact but the same card could be used in more than one group. A card, from GM9ZZZ for example, could be used to confirm a square, county, country and even the distance category. When you claim your award you will need to send in a list of the QSLs you hold to confirm each section but *not* the cards. We will then make a random selection of a few cards that we want you to send to back up your claim and, assuming everything is in order, your cards and the certificate will be on the way to you.

No records will be kept so if you want to update to a higher grade it will be treated as a new claim. The awards are also available to VHF listeners, of course.

Getting the cards

The best way of getting the cards is to use the RSGB QSL bureau system. Many people are not aware that you can use the system without being a member of the RSGB. The only snag is that a non member can only use it on an inward basis, not to send cards out. This is because sending cards out costs postage and you can't really expect to get something for nothing.

You will need to send some stamped SAEs to the person who handles your incoming cards, with your callsign clearly marked in the top left hand corner. (The address of the person who handles your cards can be obtained from the RSGB at the address given earlier in the article). Do not expect to get cards back in a week, the manager will wait until your envelope is reasonably full before sending it on to you. Do not give up hope of receiving that QSL card you are still waiting for: I recently received a card from an LA station confirming a contact made seven years ago!

Things to do

Listed in the table are some dates for your diary of the contests and rallies that we have been informed of so far. These and our new certificates should be enough to keep you going for some time. If you have details of rallies, contests or other activities please send them to me at *81 Ringwood Highway, Coventry,* from where you can also get details of the certificates and get your Maidenhead locator computed for you if you send details of your latitude and longitude. Please enclose an SAE, or at least a stamp, with your enquiry.

CONTESTS AND RALLIES

Feb	10th	70MHz cumulative contest
	17th	432MHz fixed contest
	24th	70MHz cumulative contest
March	2/3rd	144/432MHz contest
	10th	70MHz cumulative Northern Rally at Belle Vue Pontefract Rally
	24th	70MHz cumulative White Rose Rally at Leeds
	31st	432MHz CW contest
April	21st	70MHz contest Lough Erne Rally at Enniskillen

QSL CA

Terry Weat

QSL cards come in all shapes and sizes and vary from the very simple to the very ornate. All, of course, give the basic details of the time and date of the contact together with the details of the owner's station and usually a cheery message. In this article I will illustrate from my collection the various types of card in circulation. Indeed a collection of 'types' can be as interesting a collection for DXCC.

Many cards are rather like the author's own – G3WDI – functional. They feature a large callsign and space for the contact and station details. Neat and tidy but hardly artistic. Let's look at some of the alternatives to this, the 'bread and butter' card.

The view cards of VE1TG and 9H4H are two examples which have the call and location printed over a view of the home state, town or village. Sometimes there is a line drawing and/or a map to help locate the town and give something of its flavour. DB2BP's card shows this type clearly.

The 9J2DT card shows a variation of this style. An animal indigenous to the country is used. The card is supplied by the Zambia National Tourist Board and carries the message 'Greetings from Zambia' on the back. The QSL is seen by Zambia, at least, as a means of spreading goodwill for the country of origin.

When I was newly licensed, ten metres was 'wide open' and with 50 watts of AM you could work the world. Contacts with the USSR were very easily made and the UAs always QSL. Many of the Russian cards showed the latest Russian space probe. On UTSME's card Yuri Gagarin (licensed as UA1LO but that's another story) is shown after his first spaceflight, on April 12th 1961. UK5QAO's card shows the Lunik of 1966, while UB5FWJ shows the dogs Weterok and Ugolyok, who flew in Cosmos-110 and landed on March 16th of that year. Also from 1966, we have the

RD ART

ıerley G3WDI

LUNA 10 orbiting the moon. RA6HCF shows the Venura probe of 1967. RA1WAP shows Soyuz 4 and 5 linking together with a cosmonaut space-walking between the two in 1969. K2UTC's card is the only one to show the Americans on the moon.

Other Russian cards show 'heroic scenes' but some show folk heroes. I am curious to know the origin of the character on one card sent by a Russian short wave listener (UB5064247), as he looks most un-Russian, almost like an English squire.

Some cards show the operator either in a photograph, like DJ9NY, or as a cartoon showing the operator and his location (SM6CVX). One such cartoon shows the operator DK4VK and his fab 'gear'.

Other cards too, raise a smile. DB5YH's card shows a TV set suffering TVI together with the irate viewer. A 'thinks balloon' shows the expected football match. The card from OH2WQ which says 'your effort has not been in vain. You have now worked a Finnish station' is also amusing.

Blatant advertising is rare, although some commercial organisations will supply QSL cards for licensed employees. ZS6ZE's card bears a discrete Mullard symbol. The only card I have that is a pure ad is the listener card G13863, carrying a reproduction of a famous Guinness ad (Guinness is . . . well Guinness).

While looking through my collection I came across the card showing two skaters. 'Ah', I thought, 'Torvill and Dean have received the final accolade', but no – it was from RA6LWA for a contact on ten metres in 1970!

A display showing the different styles and types would certainly brighten the shack and prove an interesting talking point for amateur and non-amateur alike. QSLing is an 'art' in more ways than one.

A MULTI-BAND GROUNDED ANTENNA

by John Heys G3BDQ

In January 1984 I had an article published in ***Amateur Radio*** which was entitled *'Grounded Half Delta Loops'*. This was one of the very few antennae I have discussed which was not actually based upon personal experience. Instead, I relied upon the wisdom of the originators of the idea, Messrs Belrose (VE2CV) and DeMaw (W1FB) together with some limited operating experience of the antenna by a few friends.

Impossible

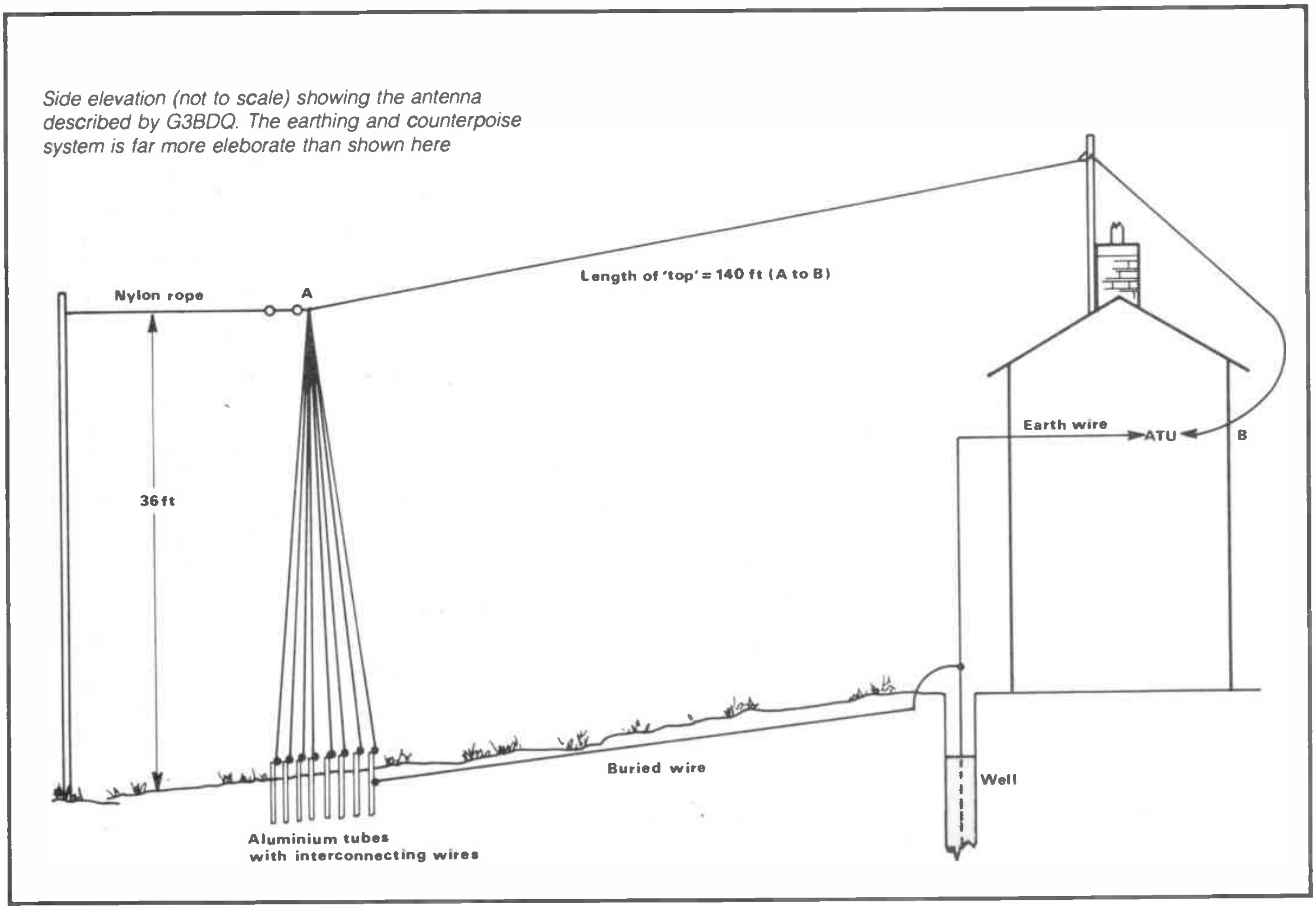
It was impossible for me to emulate such an antenna for Top Band and harmonic operation for I did not have the very necessary 80 to 100 foot tower! My garden and lawns are filled with the counterpoise and radial wires which are a must for LF DX work and I am sure my XYL would really leave home if a lofty lattice tower went up to further spoil the view. She already hints that the name of our house should be changed to *'Wiresend'* or *'The Spider's Web'!* This means I must make do with a 36 foot mast at the bottom of the garden and a pole on the chimney stack rising to about 45 feet from the ground.

DX season

Towards the end of July my thoughts turned towards the coming 160 metre DX season and some possible improvements to the existing sky-wire situation. The antenna then was an inverted 'L' about 190 feet long, which sloped down towards the east. Its current maxima (the bit which does the work) on 1.8MHz was about 126 feet in from the far end and was most certainly not at the highest point in the system. The wire was dropped to the ground and 30 feet of wire was snipped off. This action brought the maximum current area on Top Band a quarter wave from the wire end which was at the high point 45 feet up. The rest of the wire sloped down above the roof slope to the upstairs shack window.

Tests over a few weeks showed that the change was for the better and it had enhanced the DX capability on 160 metres. Contacts with HZ1AB, UA9 and UL7 stations and many USA stations were made; W2BHM being worked in full daylight on August 12th. Amateurs are never fully satisfied however, and after further arrangements thoughts were again directed toward antenna improvements. Nowhere, apart from a couple of feet in the downlead, was there any good run of vertical wire along the antenna's length so it was decided that something new must be tried.

The *half-delta loop*, as described by its inventors, had a grounded vertical section (normally the tower) from which a 206 foot wire sloped down to ground level where it was fed with low impedance coax. My maximum height at the far end of my antenna arrangements was only 36 feet but I decided to have an earthed vertical wire of that length to come down from the end of my antenna. The most convenient place to locate this was above a small rectangular asparagus bed some halfway down the garden. This meant that the top wire had to be cut yet



Side elevation (not to scale) showing the antenna described by G3BDQ. The earthing and counterpoise system is far more eleborate than shown here again, this time to 140 feet. I now had a 176 foot antenna, the last 36 feet of which came down vertically to the ground.

Good earthing

Articles about half delta loops stress the importance of good earthing at the foot of the vertical section, so I drove down about five feet of stout 1¼ inch diameter aluminium tubing to which the end of the wire connected. I also linked this earth tube with my main station/garden earth system which centres on an old well. The antenna was in no way resonant on any amateur band but the premise that any length of wire can be matched proved to be correct and the station ATU with an addition (see later paragraph) allowed an SWR of unity: the magic 1:1 on Top Band.

Tuning was in no way critical and frequency changes of plus or minus 40KHz could be made before the SWR rose to 1.5:1. This is very good for Top Band, many loaded verticals etc being most frequency conscious. Its 'flatness' or wide bandwidth is a characteristic of loop systems, which all exhibit an inherent low 'Q'. I always distrust any antenna which may be matched with a sharply tuned 1:1 SWR reading but which then needs a re-tune when only small frequency excursions are made to either side of resonance. This is a feature of short loaded antennae such as mobile whips using traps or loading coils.

The antenna as described was then given a good 'workout' on 1.8MHz and it was also surprisingly excellent on all the other bands up to 28MHz. Its performance on 7MHz was particularly good, for the vertical section worked as a vertical quarter wave radiator and many QSOs with real DX were made. Although during the winter particularly the writer's chief interest is the 160 metre band, many excursions are made to the other bands too and almost everything desirable that is heard is also worked, the writer often being 'first in the queue'.

Idle thoughts

Whilst away on holiday in September idle thoughts were turned as usual towards antennae, and seeing a VHF Discone atop a chimney stack in deepest Dorset triggered a fresh line of thought. On the first dry day following my return home the antenna was lowered and three additional 36 foot vertical wires were soldered to the end of the horizontal section. These additional three wires were thinner and lighter than the original down-wire and they were fanned out with each going to its individual aluminium rod at the corners of the asparagus plot, which measures approximately 6ft x 4ft. As the total antenna current in the vertical section is divided between the four wires a much thinner wire may be used. This reduction of current in each wire also means that the earth connection will be at a higher impedance and earth losses will be reduced. The thinner wire also reduces the possible strain upon the antenna supports.

A useful daytime check of antenna efficiency on Top Band is to take signal strength readings of a commercial CW station on about 1831KHz and also the constant carrier that seems to haunt 1825KHz. The 'S' readings do fluctuate from hour to hour and from day to day, but at my QTH they are both better than 20dB over S9 and represent useful signals for antenna tests. The new multi-wired vertical section seemed to have increased the strength of the marker signals by some 2 to 3dB so things started to look promising! With four wires the whole antenna also became even less frequency conscious and more broadbanded.

DX results

In late September and through most of October much Top Band DX was worked. My signals now had a greater proportion of vertical polarisation and the antenna seemed to reduce incoming and my outgoing signals after dark to middle distances; that is over the UK and into the nearer parts of Europe. No longer were PA0HIP or EA3VY blocking my receiver! At distances beyond 2,000 miles the improvement was dramatic for I received many S7 and S8 reports from the USA and was hearing things that were formerly down in the noise.

The antenna worked as well as ever on the other bands and 'plums' such as D68WB, 3B8FK, J28EG and A61AA were easily worked on 21 or 14MHz. The members of my local Top Band *'natter net'* also noticed a big increase in my signal put out from the 2 watt AM rig. The strength of ground wave went up spectacularly; a station about 18 miles away who formerly never gave me better than S6-7 reported my signals at a new and consistent S9.

Similar system

One of the British Top Band stalwarts is Dave G4AKY who spent an hour or so at the G3BDQ homestead when visiting in the area. We discussed various Top Band topics and antennae in particular. Dave surprisingly had adopted a similar antenna system at his new QTH where he faces a restriction in antenna length. He uses five vertical wires down from his horizontal top, and these are soldered to tin cans buried in the ground. His locals reported a 3dB increase in ground-wave signal when he went up from one vertical wire to five!

More down wires

Following his visit my antenna came down again and now it sports eight vertical down wires, each going to its own aluminium earthing rod. All these rods are inter-connected with heavy wires and go to the common earthing system. In the shack an ohm-meter between the free end of the antenna and the earth wires at the ATU shows no measurable resistance: certainly under 0.1ohm. This has the added bonus of being some protection against lightning, for the vertical section acts as a lightning conductor and the antenna cannot build up static charges.

All closed loop antennae have lower noise levels than open-ended systems such as long wires or dipoles. The QRN levels are reduced and it is often possible to work on through quite noisy conditions. On Top Band the antenna can be regarded as either a grounded loop or as a top loaded quarter wave. You pays your money and takes your choice!

On 160 metres the antenna shows some directivity along the line of the top wire, but it is not significant. It does in my case, however, reduce the strength of certain strong SM and EA stations which is a blessing when DX hunting. One SM by the way has six full sized vertical quarter waves which can be phased to work as a switched beam every 60 degrees round the compass. He also uses some 26Km of ground wire, but that is another story! On the other bands stations are workable from all over the globe with no noticeable nulls or gaps in the radiation pattern, and low angle radiation seems to be inherent.

Awkward impedance

Most, if not all, commercially made ATUs, even the very highly priced ones, cannot cope with very high or very low impedances. It is inevitable that on some bands the grounded loop will present the ATU with an awkward impedance which seems quite unmatchable, so the use of an 'outboard' 'L' section ATU is needed. I use one on Top Band and also on 7MHz, for here the shack ATU could not get the SWR below 1.7:1. The other bands can be tuned normally.

The very high or very low impedance of the antenna which normal ATUs cannot cope with (most only manage antenna impedances between 500 and 10 ohms) may be brought to a sensible value with the 'outboard' unit. This unit is a large coil with lots of tapping points and a variable capacitor (one end grounded) which may be connected by 'croc' clips to either end of the coil. This means that both 'high-in low-out' and the converse can be handled. The output from the additional 'L' section then goes through the usual station ATU. The additional tuned circuit also reduces the chances of out of band signals going out or coming in!

'Batteries'

After he had seen my aluminium ground stakes and other bits of aluminium earthing arrangements G4AKY resolved to do something about his tin cans! In an earlier article dealing with earthing systems I stressed the advantages of aluminium over other metals for amateur earthing. Dissimilar metals should *never* be used, even when located some metres apart. Such use will create 'batteries', so increasing the chances of corrosion and certainly raising noise levels.

Soldering

One problem of course when using aluminium is that it is not easily soldered. Soldering to a hefty metal tube when it has been sunk into the ground for most of its length is far from easy even when the tube is made of copper, so the writer makes good mechanical connections with aluminium 'greenhouse' nuts and bolts, then liberally coats everything with a thick application of silicon rubber sealant. This has proved to be very effective and the silicone rubber protects the connections through any weathering and also seems distasteful to the many creepy crawlies which inhabit my garden. My ants eat anything! The vertical down-wires may be arranged around a square, a rectangle, a circle or 'what-have-you' so long as they are equally spaced.

Improvement

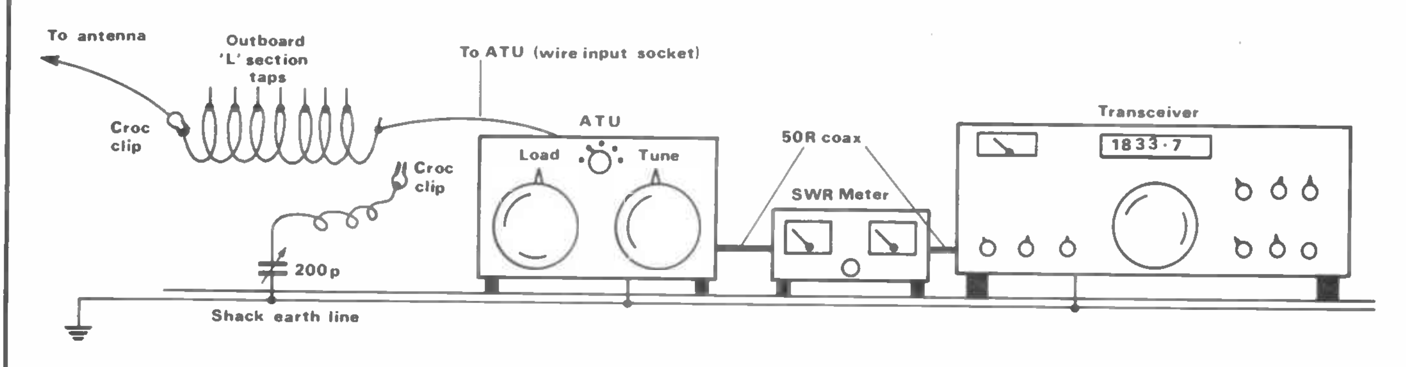
The improvement gained in going up from four to eight down-wires has been marginal, so the use of four or five wires is adequate. Increasing the number of wires becomes an exercise of diminishing returns; at first the improvement is dramatic, and then it falls off. This is understandable, for when more than about eight or ten wires are used there is little to be gained. Such a number at HF (including Top Band) so close together in terms of wavelength resembles a solid cone of metal. This effect is also noticed when putting out radials for a ground plane antenna. To go from four to eight wires only seems to increase signals by half one dB. A better earthing and or counterpoise system will pay far greater dividends.

Should the reader only be able to have a vertical section no longer than 20 feet all is not lost. Such a length will still provide useful advantages over a horizontal low wire. Although a full quarter wavelength on Top Band is around 126 feet, most of the radiated power will be from the lower half of this. The lucky types with 60 or 70 foot verticals for the band do very well indeed, for such a length will contain most of the high current section of the antenna.

My 176 foot wire plus an earth downlead of about 30 feet and then the 'L' section of the additional ATU brings the whole system to about a half wavelength on 1.8MHz. The ground 'image' below the antenna represents another half-wave loop so the whole thing is rather like a full wave quad loop. The designers of the half delta antenna wanted a low impedance feed so they had to make their systems resonant on the band. By using a matching device and bringing the end into the shack the antenna length is no longer critical.

Go vertical!

Using this kind of antenna do not expect tremendous signal reports from the UK or near Europeans outside your ground wave range (about 30 miles). If you want a big signal over the UK a 'low' dipole up at from 40 to 50 feet is needed; but such a beast will be almost useless for the real DX with its high angles of radiation. For the DX 'go vertical'.



Suggested shack arrangement when using an antenna which presents an impedance difficult to match using the normal ATU. The coil used in the outboard 'L' section is wound with 18 swg enamelled wire for 3 inches on a 3 inch diameter former and tapped at frequent intervals, every 3 or 4 turns. the coil has 29 complete turns and the variable capacitor may be connected to either end depending upon the impedance of the antenna on a particular band. Tune for best SWR using just the station ATU and then adjust the outboard section for the lowest SWR possible; unity or better than 1.3:1 can be achieved

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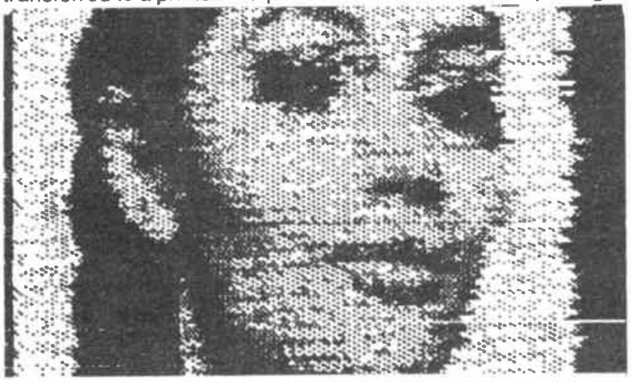

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The opening date is 1 January 1985 and further details are available in *SWL* (page 37)

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Gold	21	50	60	1200 Km
432 MHz				
Bronze	5	15	40	400 Km
Silver	10	15	30	600 Km
Gold	15	25	45	900 Km
1296MHz				
Bronze	3	10	10	300 Km
Silver	6	15	20	500 Km
Gold	9	20	30	700 Km

The opening date is 1 January 1985 and further details are available in *On the Beam* (page 44)

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The **Northern Amateur Radio Societies Association** will be holding their 23rd. Annual Radio & Electronics Exhibition and Mobile Rally in the **Central Hall, BELLE VUE, Redgate Lane, Longsight, Manchester on Sunday, 10th. March, 1985 commencing at 11-00am.**

Admission will be £1 to the exhibition

Car park facilities are available as will be restaurant and bar.

Contests and a raffle will take place.

Talk in will be on **S22, SU8,** or any other clear frequency.

SHORT WAVE LISTENER

TREVOR MORGAN GW4OXB

It's funny how people without an insight into a given hobby tend to be a bit offhand about those who are absorbed by their pastime. I suppose I am as bad as anyone else on this score as my television 'off' button is fully operational on Saturday afternoons while literally millions of soccer fans are *glued to the box*.

However, when you are involved in the same hobby, such as amateur radio, it is surprising how antagonistic or disinterested members of one branch of the hobby can be towards another.

It wasn't so long ago when it was a natural progression to start in the listening field and proceed to the HF operating part of the hobby via two metres. However, times change and now, in the days of so called 'black boxes', it is quite normal to have a newly licensed amateur on HF who has come straight from *the tech* onto the bands, having never used a receiver or even a two metre rig.

Now, there's nothing basically wrong with that, and in fact there are some very good operators on the bands today who have never used a receiver in their lives. But, these operators have missed not only the grounding that short wave listening gave the old timer (if you'll pardon the expression), but an intrinsic part of the overall hobby of amateur radio.

Many facets

This hobby contains many facets, among which short wave listening is just one. Yet, within the world of the listener there are as many branches as there are in the hobby as a whole. Further, within the listening fraternity there are those who have widely differing reasons for interest in amateur radio and methods of getting pleasure from the hobby.

Some time ago, a well respected ham mused that there are many separate and unique hobbies within the hobby and a distinct lack of affinity between the protagonists of each of the branches.

Closed shop

Hobbyists in general are well known to be somewhat *closed shop* within their own sphere, and whereas we would tend to regard a person who spent hours collecting bits of coloured rock as a bit odd we think nothing of personally spending hours separated from one's family in a sideroom or garden shed twiddling the knobs on a radio set. The hobbies are entirely different but the interest and devotion are the same.

So, with this in mind, why do so many amateurs regard the short wave listener as a lesser being? The same devotion to the hobby is there; the same keenness to learn all there is to learn about equipment and its use is evident on both sides.

As far as the manufacturing industry goes, the keen short wave listener will spend almost as much on receivers, antennae and various accessories as the average licensed amateur. Publishers could probably sell nearly as many magazines to listeners as they do to licensed amateurs. The same goes for books and other items of interest to the short wave listener. The problem is that the listener is no longer taken seriously enough to make him a commercially viable proposition.

As a result of this less and less space is given over to listeners in magazines (which is where ***Amateur Radio*** scores with, on average, more listener orientated pages than any other magazine), less new equipment is available with some companies practically disappearing from the market, preventing new people from becoming interested in listening . . . the ever decreasing spiral.

So, having stirred up this month's hornets' nest, we will plod on with the main topic of the month.

Contests

Any weekend you can tune in to the amateur bands and hear calls of 'CQ CQ Contest'. To some they are the bread and butter of the game while to others they are, to put it very politely, a thorn in the backside! To the short wave listener they can be the means of hearing more prefixes than at any other time or a waste of valuable space on already crowded bands. Whatever your feelings, they are part and parcel of this hobby of ours and can be cursed, ignored or worked . . . the decision is yours.

Many of the contests have a short wave listeners section and awards are given to those with the highest scores at the end of the contest, exactly as for the licensed operators for whom the contest was probably intended in the first place (there are special contests for listeners . . . more anon).

The idea

Basically, the idea behind the contest is to use your equipment and your knowledge to best advantage to make as many contacts as possible within a given period. Now this sounds simple in itself, but don't be fooled! Some people spend weeks ahead planning strategy, testing equipment, trying out wrinkles and checking propagation forecasts ready for the big day when, at the given time for the start of the contest, all hell will break loose on the frequencies in use!

CRAY VALLEY RADIO SOCIETY 14th SWL CONTEST 1984

Name and callsign	No of QSOs	Country multipliers	Total
CW SECTION SINGLE OPERATOR			
Donald Piccirillo BRS 52868	530	158	83740 ★
John Goodrick BRS 44395	517	143	73931
Dick Stanbridge RS 31879	291	108	31428
PHONE SECTION SINGLE OPERATOR			
Frans Van Oostenbrugge NL 4483	353	139	49067 ★
Raymond Binet ONL 6866	342	135	46170 ★
Jean-Jacques Yerganian ONL 383	287	154	44198
Norman Henbrey BRS 28198	250	150	37500 ★
Brenda Hunt BRS 46999	253	101	25553
Marc Domen ONL 6945	192	109	20928
Graeme Casselton RS 44984	143	83	11869 ★
Tony Aspinwall G SWL	155	72	11160
Mike Dawson BRS 44083	69	35	2415
Ewald Bartunek OE1 0140	44	28	1100 ★
Jan Wiollavz SP 0604 BB	33	27	981 ★
PHONE MULTI-OPERATOR			
David Whitaker & Arthur Miller	435	171	74385 ★
Marcus & Dominic Walden	233	109	25397

★ Certificate winners

Anyone who runs away with the idea that a short wave listener has any easier a time just doesn't know the name of the game.

The annual 'Contest Calender' is printed and frequently updated in *Radio Communication*, the monthly organ of the RSGB. The calender gives brief details of forthcoming contests and these are enlarged upon and necessary rules given in later editions.

So what is required to enter one of the many contests?

The details of the contest must be thoroughly studied well in advance. The organisers will have based their rules on definite guidelines and breaches of the rules can incur penalties. These can be simply a loss of points from your overall score but can also involve the disqualification of your valued entry!

Firstly, write to the organiser for a copy of the rules – unless they have been published. Secondly, check whether special log sheets are needed, if so these can be obtained from the organisers or the RSGB. Organisers seem to bear a close relationship to the chap who wrote your house insurance policy and it is advisable to read and re-read the rules to make yourself fully aware of them before the day.

Points

Points are usually awarded per contact with a mysterious thing called a multiplier which can either multiply the points scored at the time of contacting him or the total points scored overall or . . . well, read it again!

Contests can take place on one band, or part of a band, or over the entire amateur spectrum so check carefully. Out of declared zone working also causes penalties.

Check which countries are taking part. This is important for two reasons. The first is obvious as trying to explain a contest operation to a non participating party can be time-wasting and downright frustrating. Secondly, the old matter of propagation comes in to the act here as never before in your innocent listening life.

The short wave listener is on a par with the solo amateur in a contest as he usually has to do his own log keeping and checking as well as keeping accurate scores, rolling his own fags and screaming at the kids to keep quiet!

Good terms

It is prudent, as the great day approaches, to be on good terms with the neighbours, who will undoubtedly suffer a sudden onset of the dreaded TVIs and the wife who, although knowing you're not down the pub with the lads, will be expected to keep you supplied with char and wads (tea and sarnies) for the period of the contest.

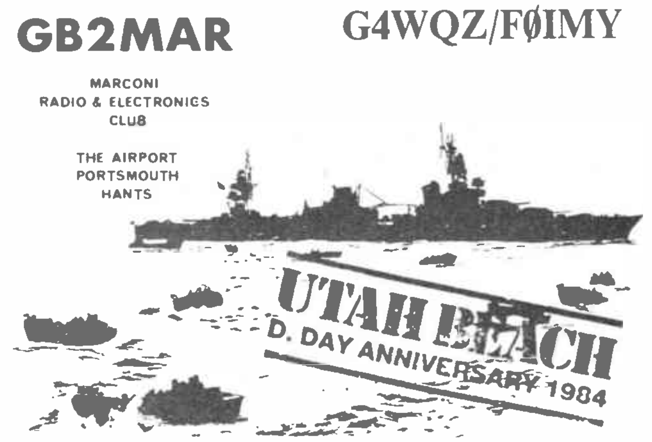
As far as equipment is concerned, you should already be aware of your receiver's ability, or lack of it, for DXing and should choose your contest accordingly. That aerial you've been using 'successfully' for ages could be a liability in some contests, all depending on the area to be covered and the bands to be used. The use of an ATU is of more importance in a contest than during that casual flip through the bands, and you may find the humble G5RV or endfed wire far better for contesting than that DXers dream of a beam because you will be listening for calls from all stations of the compass and the directionality of the beam would be a definite disadvantage here.

Audio filtering is a good bet and can make the difference between a contact and a 'got-away' with the bands crammed with stations all begging for points.

Headphones are a must for any serious contester. The super-duper hi-fi headphones so beloved during 'Bizet's Carmen' can be a positive drag on short wave. Those tweeters and woofers will pull in the QRM like magnets. Good communications headphones have the response 'tailored' round the range of the human voice so that a lot of the unwanted rubbish is excluded or at least reduced.

If you can't afford them, a pair of the cheaper lightweight phones could be used. Remember, you may be wearing them for hours at a time and your ears are going to be pretty hot under them. I prefer to wear headphones just a little forward of the ears so that any sudden plops or shrieks don't result in perforated eardrums!

There's not much point in sending reports to contest



stations as they are well aware from their contacts where their signals are going.

In most contests it is necessary for listeners to have logged both sides of the QSO and provide exchanged reports as well as their own and also any contest serial numbers given. These numbers are given on each contact and may be area codes, zone numbers or the position in the log. Alternatively, counties may be given (or the local equivalent) and these must be entered on the sheet. Once again, close examination of the rules is of the utmost importance.

Nervous

If you've never entered a contest before and are a bit nervous, next time you hear one in progress try logging the stations you hear. You may find yourself hooked!

For those of you who had a go at the Cray Valley Radio Society SWL Contest, we print the results herewith and congratulations to the winners of the respective sections!

If your club has a listeners' contest coming up or a contest with a listeners section, please let me know so that we can publicise it. *Two months notice please.*

Local activity

With the sunspot activity getting down to the 30s and even less at times, activity on the bands has been fairly local with the occasional opening for long distance contacts at varying times of the day.During a week in November, even operating a special event was sadly lacking in DX, with only the odd catch.

Talking of special events, this is one of the specialised interests that can be undertaken by a listener with the most limited of equipment.

An event station can be licensed by the DTI to any full licence holder for a special occasion. In this country, special event callsigns have the prefixes GB2, GB4 or GB0 allocated with the suffix usually referring to the event in question. For instance, a traction engine rally might attract the call GB2TER. The suffix is chosen by the applicant or the sponsor such as the local council, club association, etc.

In other countries, the special callsign can bear no relationship to the country's normal range of prefixes. For instance, 4N4SA was the callsign of the Sarajevo Winter Olympic station in Yugoslavia (normally YU series). However, the Geoff Watts DX list comes in handy again as most of the currently issued callsigns are listed for easy reference.

Most of the special stations make an effort to present a specially designed QSL card, which is one reason why the hunting of these stations is so popular amongst both the licensed and listening fraternities.

As there are so many of these stations on the air in the GB area, an extensive collection of cards can be made, even using modest equipment, but please make your report worth the effort!

Next month

Next month we'll have the result of the QSL card competition. Don't forget, this is the listeners' section so let's have some news of your activities or if you have something you'd like to see in the section, let me know. Good listening.

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MC1310P	1.95
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MC1330P	1.10
MC1349P	1.20
MC1350P	0.95
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MC1357	2.35
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MC145106P	7.95
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MC3401L	2.50
ML231B	1.75
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SAA5010	6.35
SAS560S	1.75
SAS570S	1.75
SAS580	2.85
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SL901B	4.65
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SL1327Q	1.10
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TAA700	1.70
TBA120AS B/-C	1.00
TBA231	1.25
TBA395	1.50
TBA396	0.75
TBA440N	2.55
TBA480Q	1.25
TBA510	2.50
TBA510Q	2.50
TBA520	1.10
TBA520Q	1.10
TBA530	1.10
TBA530Q	1.10
TBA540	1.25
TBA540Q	1.35
TBA550Q	1.95
TBA560C	1.45
TBA560Q	1.45
TBA570	1.00
TBA641A12	2.50
TBA651R	2.50

TBA720A	2.45
TBA750Q	2.65
TBA800	0.89
TBA810AS	1.65
TBA810P	1.65
TBA820M	0.75
TBA820Q	1.45
TBA890	2.50
TBA920	1.65
TBA950/2X	2.35
TBA970	2.95
TBA990	1.49
TBA990Q	1.49
TCA270	1.10
TCA270SQ	1.10
TCA650	2.50
TCA800	2.95
TCA830S	1.95
TCA900	2.50
TCA940	1.65
TDA440	2.20
TDA1001	1.95
TDA1002A	1.95
TDA1003A	3.95
TDA1004A	3.25
TDA1006A	2.50
TDA1010	2.15
TDA1035	2.50
TDA1037	1.95
TDA1044	2.15
TDA1170	1.95
TDA1190	2.15
TDA1270Q	3.95
TDA1327	1.70
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TDA2523	2.95
TDA2524	1.95
TDA2530	1.95
TDA2532	1.95
TDA2540	1.95
TDA2541	2.15
TDA2560	2.15

TDA2571	2.95
TDA2581	2.25
TDA2582	2.95
TDA2593	2.95
TDA2600	6.50
TDA2610	2.50
TDA2611A	1.95
TDA2640	3.50
TDA2680A	2.75
TDA2690	2.45
TDA3310	2.95
TDA4600	2.50
TDA9503	3.15
TDA3560	3.95
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UPC1032H	1.50
UPC1156H	2.75
UPC1158H	0.75
UPC1167C2	1.15
UPC1181H	1.25
UPC1182H	2.95
UPC1185H	3.95
UPC1191V	1.50
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UPC1353C	2.45
UPC1365C	3.95
UPC2002H	1.95
555	0.35
556	0.42
723	0.50
741	0.35
747	0.50
748	0.35
7808	0.60
7805	0.65
7815	0.65

SEMICONDUCTORS

AAY12	0.25
AC126	0.45
AC127	0.20
AC128	0.28
AC128K	0.32
AC141	0.28
AC141K	0.34
AC142K	0.30
AC176	0.22
AC176K	0.31
AC187	0.25
AC187K	0.28
AC188	0.25
AC188K	0.37
AD142	0.79
AD143	0.82
AD149	0.70
AD161	0.39
AD162	0.39
AD161/2	0.90
AF106	0.50
AF114	1.95
AF121	0.60
AF124	0.65
AF125	0.35
AF126	0.32
AF127	0.65
AF139	0.40
AF150	0.60
AF178	1.95
AF239	0.42
AU106	4.50
AU107	3.50
AU110	2.00
AY102	2.95
BC107A	0.11
BC107B	0.11
BC108	0.10
BC108A	0.11
BC108B	0.12
BC109	0.10
BC109B	0.12
BC109C	0.12
BC114	0.11
BC116A	0.15
BC117	0.19
BC119	0.24
BC125	0.25
BC139	0.20
BC140	0.31
BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC147B	0.09
BC148A	0.09
BC148B	0.09
BC149	0.09
BC153	0.30
BC157	0.12
BC158	0.09
BC159	0.09
BC160	0.28
BC161	0.28
BC170B	0.15
BC171	0.09
BC171A	0.10
BC171B	0.10
BC172	0.10
BC172B	0.10
BC172C	0.10
BC173B	0.10
BC174	0.09
BC174A	0.09
BC177	0.15

BC178	0.15
BC182	0.10
BC182LB	0.10
BC183	0.10
BC183L	0.09
BC184LB	0.09
BC204	0.10
BC207B	0.13
BC208B	0.13
BC212	0.09
BC212L	0.09
BC212LA	0.09
BC213	0.09
BC213L	0.09
BC214	0.09
BC214C	0.09
BC214L	0.09
BC237B	0.09
BC238	0.09
BC239	0.12
BC251A	0.12
BC252A	0.15
BC258	0.25
BC258A	0.39
BC284	0.30
BC300	0.30
BC301	0.30
BC303	0.26
BC307B	0.09
BC327	0.10
BC328	0.10
BC337	0.10
BC338	0.09
BC347A	0.13
BC461	0.35
BC478	0.20
BC527	0.20
BC547	0.10
BC548	0.10
BC549A	0.10
BC550	0.14
BC557	0.08
BC557B	0.08
BC558	0.10
BC639/10	0.30
BCY33A	1.60
BD115	0.30
BD116	0.60
BD124P	0.59
BD131	0.42
BD132	0.42
BD133	0.40
BD135	0.30
BD136	0.30
BD137	0.32
BD138	0.30
BD139	0.32
BD140	0.30
BD144	1.10
BD150C	0.29
BD159	0.65
BD160	1.50
BD166	0.55
BD179	0.72
BD182	0.70
BD201	0.83
BD202	0.65
BD203	0.78
BD204	0.70
BD222	0.46
BD223	0.59
BD225	0.48
BD232	0.35
BD233	0.35
BD234	0.35
BD236	0.49

BD237	0.40
BD238	0.40
BD242	0.65
BD246	0.75
BD376	0.32
BD410	0.65
BD434	0.65
BD437	0.75
BD438	0.75
BD520	0.65
BD538	0.65
BD597	0.95
BD701	1.25
BD702	1.25
BD707	0.90
BDX32	1.50
BDY57	1.65
BF115	0.35
BF119	0.65
BF127	0.39
BF154	0.20
BF158	0.22
BF160	0.22
BF167	0.27
BF173	0.22
BF177	0.38
BF178	0.26
BF179	0.34
BF180	0.29
BF181	0.29
BF182	0.29
BF183	0.29
BF184	0.28
BF185	0.28
BF194	0.11
BF195	0.11
BF196	0.11
BF197	0.11
BF198	0.16
BF199	0.14
BF200	0.40
BF241	0.15
BF245	0.30
BF257	0.28
BF258	0.28
BF259	0.28
BF271	0.26
BF273	0.18
BF336	0.34
BF337	0.29
BF338	0.32
BF355	0.37
BF362	0.38
BF363	0.65
BF371	0.25
BF394	0.19
BF422	0.32
BF423	0.25
BF457	0.32
BF458	0.36
BF467	0.68
BF595	0.23
BF597	0.25
BFR39	0.23
BFR40	0.23
BFR41	0.23
BFR81	0.25
BFR88	0.30
BFR90	1.50
BFR91	1.75
BFT42	0.35
BFT43	0.35
BFW61	0.60
BFW92	0.85
BFX29	0.30

BFX84	0.26
BFX85	0.32
BFX86	0.30
BFX88	0.25
BFY50	0.21
BFY51	0.21
BFY52	0.25
BFY90	0.77
BLY48	1.75
BR100	0.26
BR101	0.49
BR103	0.55
BR303	0.95
BRC4443	1.15
BT100A/02	0.85
BT106	1.49
BT116	1.20
BT119	3.15
BT120	1.65
BU105	1.95
BU108	1.69
BU124	1.25
BU125	1.25
BU126	1.60
BU204	1.55
BU205	1.30
BU208	1.39
BU208A	1.52
BU208D	1.85
BU326	1.20
BU326S	1.50
BU407	1.24
BU500	2.25
BU526	1.90
BU807	2.25
BUY20	2.15
BUY69B	1.70
MJ3000	1.98
MJE340	0.40
MJE350	
MJE520	0.45
MJE2955	
MPSA13	0.29
MPSA92	0.30
MRF237	3.45
MRF450A	12.50
MRF453	17.50
MRF454	23.50
MRF455	17.50
MRF475	2.50
MRF477	10.00
OC16W	1.95
OC23	1.50
OC29	2.25
OC36	2.25
OC42	0.75
OC44	0.75
OC45	0.55
OC70	0.45
OC71	0.55
OC75	0.95
OC81	0.50
OC16W	2.50
R2008B	1.45
R2010B	1.45
R2322	0.58
R2323	0.66
R2540	2.45
RCA16334	0.90
RCA16335	0.80
S2060D	0.95
SKE5F	1.45
TIP29	0.40
TIP29C	0.42

TIP30C	0.43
TIP31C	0.55
TIP32C	0.42
TIP33B	0.95
TIP34B	0.95
TIP41A	0.45
TIP41C	0.45
TIP42C	0.47
TIP47	0.65
TIP120	0.60
TIP125	0.65
TIP142	1.75
TIP146	2.75
TIP161	2.95
TIP2955	0.80
TIP3055	0.55
TIS91	0.20
TV106/2	1.50
ZRF0112	16.50
2N1100	6.50
2N1711	0.30
2N2110	4.50
2N2219	0.28
2N2905	0.40
2N3053	0.40
2N3054	0.59
2N3055	0.52
2N3702	0.12
2N3703	0.12
2N3704	0.12
2N3705	0.12
2N3706	0.12
2N3708	0.12
2N3733	9.50
2N3773	2.75
2N3792	1.35
2N4280	3.50
2N4427	1.95
2N4444	1.15
2N5294	0.42
2N5296	0.48
2N5298	0.60
2N5496	0.95
2SA329	0.95
2SA715	0.60
2SC495	0.80
2SC496	0.80
2SC931D	0.95
2SC1096	0.80
2SC1106	2.50
2SC1172Y	2.20
2SC1173	1.15
2SC1306	1.00
2SC1307	1.50
2SC1364	0.50
2SC1449	0.50
2SC1678	1.25
2SC1909	1.45
2SC1945	2.65
2SC1953	0.95
2SC1957	0.80
2SC1969	1.95
2SC2028	1.15
2SC2029	1.95
2SC2078	1.45
2SC2091	0.85
2SC2098	2.50
2SC2166	1.95
2SC2314	0.80
2SC2371	0.36
2SC931D	0.95
1SD234	0.50
2SD325E	1.65
3N211	1.95
3SK45	0.95
3SK88	0.55

NEW BRANDED CATHODE RAY TUBES

A1865/20	65.00
AW36.11	25.00
CME822W	19.00
CME822GH	25.00
CME1428GH	45.00
CME1428W	39.00
CME1523GA	39.00
CME1523W	39.00
CME1431GH	39.00
CME1431W	39.00
CME202GH	45.00
CME2024W	45.00
CME2325W	45.00
CME3126GH	45.00
CME3128GH	45.00
CME3128W	45.00
CME3132GH	45.00
CME3155W	45.00
CRE1400	25.00
CV429	89.00
CV1450	35.00
CV1526	19.00
CV2185	15.00
CV2191	19.00
CV2193	15.00
CV2328	55.00
CV5119	85.00
CV5320	65.00
CVX389	55.00
D9-110GH	39.50
D9-120	45.00
D10-210GH	45.00
D10-210GH68B	65.00
D10-210GH72	65.00
D10-230GH	35.00
D10-230GM	35.00
D10/293GY/90	55.00
D13-27GH	49.50
D13-30GH	49.50
D13-33GM	49.00
D13-47GH/26	55.00
D13-47GH/34	55.00
D13-47GH	55.00
D13-51GL/26	85.00
D13-51GM/26	85.00
D13-450GH/01	55.00
D13-471GH/26	55.00
D13-550GH	65.00
D13-600GM	59.00
D13-610GH	59.00
D13-610GM	59.00
D13-611GH	59.00
D13-611GM	59.00
D13-630GH	59.00
D14-120GH08	65.00
D14-150GH	75.00
D14-150GM	75.00
D14-172GH/84	59.00
D14-172GR	55.00
D14-172GV	55.00
D14-173GH	55.00
D14-173GM	53.00
D14-173GR	55.00
D14-181GH/62	65.00
D14-181GH/98	65.00
D14-181GJ	55.00
D14-181GM	53.00
D14-181GM50	59.00
D14-182GH	59.00
D14-182GM/98	65.00
D14-200BE	89.00
D14-200GA/50	85.00

D14-210GH	75.00
D14-270GH/50	75.00
D14-310W	110.00
D14-320GH	85.00
D14-320GH/82	85.00
D14-340GH/KM	45.00
D14-340KA	45.00
D16-100GH	65.00
D16-100GH/65	69.00
D16-100GH/67	65.00
D18-100GH67A	75.00
D16-100GH/79	59.00
D16-100GH79A	75.00
D16-100GH97	65.00
D18-130GH/70	59.00
D18-160GH	59.00
D21-10GH	65.00
D21-10GJ	69.00
D21-10LD	69.00
DB7 36	35.00
DB7.36	55.00
DG7 5	55.00
DG7 32	45.00
DH3 91	55.00
DH7 91	45.00
DP7.5	35.00
DP7.6	35.00
DN13 78	35.00
F15-101LC	49.00
F16-101GM	55.00
F16-101LD	55.00
F21-130GR	55.00
F21-130LC	55.00
F21-131GR	79.00
F31-10GM	65.00
F31-10GR	65.00
F31-10LC	65.00
F31-10LD	65.00
F31-12LC	65.00
F31-12LD	65.00
F31-13GR	65.00
F31-13LD	65.00
F31-13LG	65.00
F41-123LC	150.00
F41-141LG	160.00
F41-142LC	185.00
M7-120W	19.00
M14-100GM	45.00
M14-100KA	55.00
M14.100LC	45.00
M17-151GVR	175.00
M17-151GR	175.00
M19-100GY	55.00
M19-101GR	55.00
M19-103W	58.00
M23-110GH	55.00
M23-111W	55.00
M23-111GH	55.00
M23-111LD	55.00
M23-112GM	55.00
M23-112GV	55.00
M23-112GW	55.00
M23-112KA	55.00
M23-112LD	55.00
M23-112W	55.00
M24-120GM	59.00
M24-120GR	59.00
M24-120LC	59.00
M24-120WAR	59.00
M24-121GH	55.00
M24-121LC	59.00
M24-121WA	59.00

M28-11LA	49.00
M28-12GH	55.00
M28-12LC	55.00
M28-13LC	49.00
M28-13LG	49.00
M28-13GR	49.00
M28-13WA	49.00
M28-131GR	55.00
M28-132GM	55.00
M28-133GH	55.00
M31-100GH	55.00
M31-101GH	55.00
M31-182GR	55.00
M31-182GV	53.00
M31-183W	55.00
M31-184W	65.00
M31-184GH	65.00
M31-184P31	65.00
M31-185GH/VR	69.00
M31-186W	69.00
M31-190GH	55.00
M31-190GR	55.00
M31-190LA	55.00
M31-190W	59.00
M31-191GH	59.00
M31-191GR	59.00
M31-191GV	55.00
M31-191W	59.00
M31-192W	59.00
M31-195GH	59.00
M31-210GH	59.00
M31-220W	59.00
M31-270GY	65.00
M31-271P31	65.00
M31-271GW	65.00
M31-271W	65.00
M36-12W	75.00
M36-141LA	75.00
M36-141LG	75.00
M36-141W	75.00
M36-170LG	75.00
M38-103GR	65.00
M38-113GH	65.00
M38-120W	65.00
M38-120WA	65.00
M38-121GR	65.00
M38-121GHR	65.00
M38-121LA	65.00
M38-121WA	65.00
M38-122GW	65.00
M38-140LA	65.00
M38-141LA	65.00
M38-142GR	65.00
M38-142LA	65.00
M38-340P31	65.00
M38-341GR	65.00
M38-341P31	65.00
M38-344P39	65.00
M40-120W	89.00
M43-12GM/01	65.00
M43-12LG/01	65.00
M44-120LC	65.00
M44-120GR	65.00
M47-25GR/22	65.00
M50-120GH	65.00
M50-120GR	65.00
M50-120GV	65.00
M50-120LC	65.00
M61-120LC	75.00
M61-120W	75.00
M61-120W	75.00
S6AR	45.00
SE42BP31AL	55.00

SE42BP31	65.00
SE52AP31AL	55.00
SE5Fp31	55.00
T937	65.00
T948N	65.00
T948H	65.00
V3191	59.00
V4150LC	55.00
V4254B	65.00
V4274GH	65.00
V4283W	65.00
V5002LD	65.00
V5004GR	59.00
V5004LD	59.00
V6001GH	65.00
V6006GH	65.00
V6007DP31	59.00
V6007GW	65.00
V6008GH	59.00
V6008W	65.00
V6034WA	59.00
V604CLA	59.00
V6048F	65.00
V6048J	49.00
V6052GH	65.00
V6052GR	65.00
V6064BLA	65.00
V6064BP31	55.00
V6064CLA	55.00
V6069GH	55.00
V6070P31	49.00
V7016A	65.00
V7030	59.00
V7031GH	59.00
V7031/67A	59.00
V7035A	49.00
V7037GH	45.00
V8004GR	65.00
V8006GH	65.00
V8010A	65.00
2BP1	9.00
3BP1	13.50
4EP1	30.00
3H/OBM	55.00
3WP1	18.50
5BP1	9.00
5BHP1	30.00
5BHP1FF	30.00
5BHP31	30.00
5CP1	10.00
6EP7/S	39.00
13BP1	13.50
13BP4	17.50
17DWP4	25.00
32J/1085	69.00
88D/88B/89D/89L	15.00
1273	39.00
1564	39.00
1844	45.00
55451GM	75.00
9442E1	80.00
95447GM	75.00
95449	75.00
7709631	79.50

ELECTRO-OPTICAL

95025	25.00
9558B	25.00
9677M	22.00
P4231BAM	19.00
XP1002	29.00
XP1117M	24.00
XP2040	35.00

DIODES

AA119	0.08
BA115	0.13
BA145	0.16
BA148	0.17
BA154	0.06
BA156	0.15
BA157	0.30
BAX13	0.04
BAX16	0.06
BB105B	0.30
BT151	0.79
BY126	0.10
BY127	0.11
BY133	0.15
BY164	0.45
BY176	1.20
BY179	0.63
BY182	0.55
BY184	0.35
BY199	0.40
BY206	0.14
BY208-800	0.33

BY210-800	0.33
BY223	0.90
BY298-400	0.22
BY299-800	0.22
BYX10	0.20
BYX36-150R	0.20
BYX38-600R	0.60
BYX55-600	0.30
BYX71-600	1.10
BZX61	0.15
BZY88	0.10
BZY95C30	0.35
CS4B	4.50
CS10B	8.45
OA47	0.09
OA90	0.05
DA91	0.06
DA95	0.06
DA202	0.10
1N21DR	5.00

1N23B	5.00
1N23C	5.00
1N23ER	5.00
1N23WE	5.00
IN4001	0.04
IN4003	0.04
IN4004	0.05
IN4005	0.05
IN4007	0.06
IN4148	0.02
IN4448	0.10
IN5401	0.12
IN5402	0.14
IN5403	0.12
IN5406	0.13
IN5407	0.16
IN5408	0.16
ITT44	0.04
ITT923	0.15
ITT2002	0.10

BASES

B5D	5.50
B7G	0.15
B7G SKTD	0.25
B8G	0.70
B8H	0.70
B9A	0.25
B9ASKTD	0.40
B9G	0.75
B10B	0.20
B13B	0.50
B14A	3.00
12 Pin CRT	0.95
Nuvistor	2.95
Octal	0.35
SK610	35.00
UX5	1.75
UX7	1.75
Valve Can	0.30
8 Pin Dil	0.14
14 Pin Dil	0.15
16 Pin Dil	0.17
18 Pin Dil	0.18

WIREWOUND RESISTORS

4 Watt 5R6-10K	0.20
7 Watt R47-22K	0.20
11 Watt 1R5-15K	0.25
17 Watt 1R-15K	0.30

ZENER DIODES BZX61 0.15

6V2 7V5 8V2 9V1 10V
11V 12V 13V 15V 16V
18V 20V 22V 24V 27V
30V 33V 36V 39V 47V
51V 56V 68V 75V

THERMISTORS

VA1040	0.23
VA1056S	0.23
VA1104	0.70
VAT8650	0.46
VA1097	0.25

BZY88 0.07

2V7 3V 3V3 3V6 3V9
4V3 4V7 5V1 5V6 6V2
6V8 7V5 6V2 9V1 10V
11V 12V 13V 15V 18V
20V 24V 27V 30V

BATTERIES

7V Power Mike batteries
TR175 £2.25 ea
other prices on request

LINE OUTPUT TRANSFORMERS

DECCA 100	7.95
DECCA 1700 MONO	9.95
DECCA 1730	8.95
DECCA 2230	8.25
GEC 2040	8.95
GRUNDIG 1500	15.45
GRUNDIG 5010-6010 2222.5011-6011	13.45
ITT CVC20	8.20
ITT CVC30	8.25
PHILIPS G8	8.50
PHILIPS G9	8.99
PHILIPS G11	13.39
PYE 725	10.95
RBM T20A	12.40
TANDBERGE 90	11.15
TELEFUNKEN 711A	11.15
THORN 1590	9.50
THORN 8000	9.20
THORN 9000	9.95
THORN 9800	22.40
THORN MAINS TRANSFORMER 3000/3500	9.70

SOLDERING EQUIPMENT

25W Antex Iron	4.59
Weller Instant Heat Gun	11.30
240V Weller Marsman	4.74
½ Kilo Solder 60/40	6.95

EHT MULTIPLIERS

ITT CVC20	6.35
ITT CVC30	6.35
PHILIPS G8 550	6.96
RANK T20A	6.91
THORN 3000/3500	7.57
THORN 8500	8.50
THORN 9000	8.00
UNIVERSAL TRIPLER	5.46

REPLACEMENT ELECTROLYTIC CAPACITORS

DECCA 30 (400-400/350V)	2.85
DECCA 80/100 (400/350V)	2.99
DECCA 1700 (200-200-400-350V)	3.55
GEC 2110 (600/300V)	2.25
ITT CVC20 (220/400V)	1.80
PHILIPS G8 (600/300V)	2.25
PHILIPS G9 (2200/63V)	1.19
PHILIPS G11 (470/250V)	2.35

POTENTIOMETERS

STANDARD VERTICAL POTS	0.12
MIN VERTICAL POTS	0.12
STANDARD HORIZONTAL POTS	0.12
MIN HORIZONTAL POTS	0.12
CONVERGENCE PRE-SETS	0.30
SLIDERS LOG	0.46
SLIDER LINEAR	0.48

SPARES & AIDS

FOAM CLEANSER	0.79
FREZE IT	0.82
SOLDA MOP	0,64
SWITCH CLEANER	0.79
WD40	1.25
PUSH PUSH MAINS SWITCH (DECCA GEC, RANK, THORN ETC)	1.02
PYE IF GAIN MODULE	6.99
ANODE CAP (27KV)	0.69

PUSH BUTTON UNITS

DECCA, ITT CVC20 6 WAY	7.95
ITT CVC5 7 WAY	10.19
PHILIPS G8 (550) 6 WAY	14.49

VARICAP TUNERS

ELC1043/05 MULLARD	8.65
ELC1043/06 MULLARD	8.65
U321	8.25
U322	8.25

20MM ANTI SURGE FUSES

100MA-800MA	15p each
1A-5AMP	12p each

20MM QUICK SLOW FUSES

100MA	8p each
200MA-5AMP	5p each

PHONE
0474 813225
3 LINES

P.M. COMPONENTS LTD

DEPT REW SELECTRON HOUSE, WROTHAM ROAD
MEOPHAM GREEN, MEOPHAM, KENT DA13 OQY

VISA

TELEX
966371
PM COMP

A SELECTION FROM OUR STOCK OF BRANDED VALVES

A1714	18.60
A1998	11.50
A2087	11.50
A2134	14.95
A2293	6.50
A2426	29.50
A2599	37.50
A2792	27.50
A2900	11.50
A3042	24.00
A3283	24.00
AC/THI	4.00
ACT22	59.75
AC/S2PEN	8.50
AH221	39.00
AH238	39.00
AL60	6.00
AN1	14.00
ARP12	0.70
ARP34	1.26
ARP35	2.00
ATP4	2.50
AX50	5.50
AZ11	4.50
AZ31	2.50
BL63	2.00
BS450	67.00
BS810	55.00
BS814	55.00
CIK	19.00
C3JA	21.00
C6A	9.00
C1112G	70.00
C1108	54.95
C1134	32.00
C1148A	115.00
C1149/1	130.00
C1150/1	136.00
C1534	32.00
CCA	2.60
CC3L	0.90
CL33	2.00
CV Nos Prices on request	
D63	1.20
DA41	22.50
DA42	17.50
DA90	4.50
DA100	125.00
DAF91	0.45
DAF91	0.70
DAF96	1.00
DC70	1.75
DC90	1.20
DCX4-1000	12.00
DCX4-5000	25.00
DET16	28.50
DET18	28.50
DET23	35.00
DET24	39.00
DET25	22.00
DF91	0.70
DF92	0.60
DF96	0.65
DF97	1.00
DH63	1.20
DH77	0.90
DH79	0.56
DH149	2.00
DK91	0.90
DK92	1.20
DK96	2.50
DL35	2.50
DL63	1.00
DL70	2.50
DL73	2.50
DL91	1.50
DL92	0.95
DL93	1.10
DL94	2.50
DL96	2.50
DLS10	13.50
DLS16	10.00
DM70	1.95
DM160	2.75
DY51	1.50
DY86/87	0.85
DY802	0.72
E55L	42.00
E80CF	11.00
E80F	18.50
E81CC	3.15
E81L	12.00
E82CC	3.50
E83CC	3.50
E83F	5.50
E86C	9.50
E88C	7.95
E88CC	3.50
E88CC Siemens Special	8.95
E90CC	7.95
E90F	7.95
E91H	4.50
E92CC	3.95
E99F	6.99
E130L	19.95
E180CC	8.50
E182CC	9.00
E180F	8.50
E186F	8.50
E188CC	7.50
E280F	19.50
E283CC	10.00
E288CC	13.50
E55L	42.00
E810F	18.15
E1148	1.00
E1524	6.95
EA50	1.00
EA76	1.95
EA79	1.95
EAA91	0.60
EABC80	0.70
EAC91	2.50
EAF42	1.20
EAF801	3.50
EB34	1.50
EB41	3.95
EB91	0.52
EBC33	2.50
EBC41	1.95
EBC81	1.50
EBC90	0.90
EBC91	0.90
EB91	0.60
EBF80	0.65
EBF83	0.65
EBF85	0.95
EBF89	0.70
EBF93	0.95
EBL1	2.50
EBL21	2.00
EC52	0.75
EC70	1.75
EC80	9.50
EC81	7.95
EC86	1.00
EC88	1.00
EC90	1.10
EC91	5.50
EC92	1.75
EC93	1.50
EC95	7.00
EC97	1.10
EC8010	12.00
ECC32	3.50
ECC33	3.50
ECC35	3.50
ECC81	1.15
ECC81 Special quality	1.95
ECC82	0.55
ECC82 Mullard	1.50
ECC82 Philips	1.95
ECC83	0.65
ECC83 Brimar	1.35
ECC83 Philips	1.95
ECC84	0.50
ECC85	0.60
ECC86	2.75
ECC88	0.85
ECC91	2.00
ECC180	0.72
ECC189	0.78
ECC801S	3.50
ECC803S	3.50
ECC804	0.60
ECC2000	12.00
ECF80	1.15
ECF82	1.15
ECF86	2.25
ECF200	1.85
ECF202	1.85
ECF801	0.85
ECF804	6.00
ECF805	2.50
ECF806	10.25
ECH3	2.50
ECH4	3.00
ECH35	2.15
ECH42	1.00
ECH81	0.65
ECH83	0.78
ECH84	0.69
ECH2000	1.50
ECL80	0.60
ECL82	0.65
ECL83	2.50
ECL84	0.74
ECL85	0.69
ECL86	0.80
ECL805	0.69
EF22	2.50
EF37A	2.00
EF39	1.10
EF41	3.50
EF42	3.50
EF50	2.50
EF55	4.95
EF71	1.50
EF72	1.20
EF73	1.00
EF80	0.55
EF83	3.50
EF85	0.50
EF86	2.25
EF86 Special quality	3.15
EF89	0.85
EF91	1.50
EF92	2.15
EF93	0.95
EF94	0.95
EF95	1.50
EF97	0.90
EF98	0.90
EF183	0.65
EF184	0.65
EF730	1.80
EF731	3.50
EF732	3.50
EF800	11.00
EF805S	13.50
EF806S	14.50
EF812	0.65
EFL200	1.50
EH90	0.72
EK90	0.72
EL32	0.95
EL33	4.00
EL34	2.25
EL34 Mullard/Phillips	4.50
EL36	1.50
EL37	9.00
EL38	4.75
EL41	3.50
EL42	2.00
EL81	6.95
EL82	0.58
EL83	5.95
EL84	0.75
EL85	4.50
EL86	0.85
EL90	1.50
EL91	6.00
EL95	0.70
EL153	12.15
EL183E	3.50
EL183P	3.50
EL360	6.75
EL500	1.40
EL504	1.40
EL509	5.25
EL519	6.95
EL802	3.65
EL821	8.50
EL822	12.95
EM1	9.00
EM4	9.00
EM80	0.70
EM81	0.70
EM84	1.65
EM85	3.95
EM87	2.50
EN10	8.00
EN32	13.50
EN91	1.10
EN92	4.50
ESU150	14.95
ESU872	25.00
EY51	0.80
EY81	2.35
EY83	1.50
EY84	5.95
EY86/87	0.50
EY88	0.55
EY91	5.50
EY500A	1.50
EY802	0.70
EZ35	0.75
EZ40	2.75
EZ41	2.15
EZ80	0.75
EZ81	0.75
EZ90	1.50
F6064	2.95
FW4/800	2.95
G55/1K	9.00
G180/2M	9.00
G232 Mullard	3.95
G240/2D	9.00
G400/1K	14.00
GC10B	17.50
GC10D	17.50
GC10/4B	17.50
GC10/4E	17.50
GC12/4B	17.50
GD86W	6.00
GDT120M	5.00
GE10	9.00
GN4	6.00
GN10	15.00
GR10G	4.00
GS10C	16.50
GS10H	12.00
GS12D	12.00
GT1C	14.00
GT1C S/S	13.00
GTE175M	8.00
GTR150W	1.00
GU20	35.00
GXU1	13.50
GXU3	24.00
GXU50SS	14.50
GY501	1.20
GY802	1.00
GZ30	1.00
GZ31	1.00
GZ32	1.00
GZ33	4.50
GZ34	2.15
GZ34MUL	3.95
GZ37	4.50
HAA91	1.00
HABC80	0.90
HBC90	0.75
HBC91	0.80
HF93	0.75
HF94	1.50
HK90	1.06
HL2K	3.50
HL23DD	4.00
HL90	0.70
HL92	1.50
H133/DD	3.50
HR2	4.00
HY90	1.00
HVR2	3.00
K3118	86.00
KR6/3	45.00
KT8C	7.00
KT33C	3.50
KT36	2.00
KT44	4.00
KT45	4.00
KT61	4.00
KT63	2.00
KT66 OSRAM	10.50
KT66 USA	6.90
KT66 GEC	14.95
KT77 Gold Lion	9.50
KT81	7.00
KT88 USA	9.00
KT88 Gold Lion	16.95
KTW61	2.50
KTW62	2.50
KTW63	2.00
KTZ63	2.50
L63	1.50
L102/2K	6.95
L120/2K	12.00
LB7-20	95.00
LS9B	6.95
M502A	60.00
M537A	60.00
M5143	185.00
M8079	6.00
M8082	7.50
M8083	3.26
M8091	7.50
M8096	3.00
M8098	5.50
M8099	6.00
M8100	5.50
M8136	7.00
M8137	5.50
M8161	6.50
M8162	5.50
M8163	5.50
M8190	4.50
M8195	6.50
M8196	5.50
M8204	5.50
M8223	4.50
M8224	2.00
M8225	3.50
ME1401	29.50
ME1402	29.50
ME1501	14.00
MH4	3.50
MHLD6	4.00
ML4	4.50
MS4B	5.50
MU14	1.50
N37	12.50
N78	9.85
OA2	0.85
OA2WA	1.50
OA3	2.50
OB2	0.85
OB2WA	1.25
OC2	2.50
OC3	1.50
OD3	1.70
OM4	1.00
OM5B	3.00
OM6	1.75
ORP43	2.50
ORP50	3.95
ORP93	12.00
P61	2.50
P41	2.50
PABC80	0.50
PC86	0.75
PC88	0.75
PC92	3.50
PC97	1.10
PC800	1.10
PC900	1.25
PCC84	0.40
PCC85	0.54
PCC88	0.70
PCC89	0.70
PCC189	0.70
PCC805	0.70
PCC806	0.80
PCE82	0.80
PCF80	0.65
PCF82	0.60
PCF84	0.65
PCF86	1.20
PCF87	0.40
PCF200	1.80
PCF201	1.80
PCF800	0.40
PCF801	1.35
PCF802	0.60
PCF805	1.25
PCF806	1.00
PCF808	1.25
PCH200	1.50
PCL82	0.85
PCL83	2.50
PCL84	0.75
PCL85	0.80
PCL86	0.85
PCL800	0.80
PCL805	0.90
PD500	3.50
PD510	3.65
PEN25	2.00
PEN40DD	2.50
PEN45	3.00
PEN45DD	3.00
PEN46	2.00
PFL200	0.95
PL21	2.50
PL36	0.95
PL38	1.50
PL81	0.72
PL81A	0.72
PL82	0.60
PL83	0.52
PL84	0.78
PL88	1.00
PL95	1.75
PL302	1.00
PL345	12.50
PL500	0.95
PL500	1.10
PL504	1.15
PL508	1.75
PL509	4.85
PL519	4.95
PL802	5.95
PL802T	3.50
PL820	2.95
PL5557	29.50
PY32	0.60
PY33	0.50
PY81	0.70
PY82	0.70
PY83	0.70
PY88	0.66
PY500A	1.95
PY800	0.79
PY801	0.79
QB3-300	54.95
QE03-10	3.50
QE08-200	£145.00
QF40	65.00
QP25	1.00
QQE03-12	6.50
QQE03-20	27.00
QQV02-6	19.50
QQV03-10 Mullard	9.50
QQV03-10	6.50
QQV03-20A	25.00
QQV03-20B	32.00
QQV06-40A	27.50
QQV07-50	63.50
QQZ03-20	42.50
QQZ06-40A	45.25
QS75/20	1.50
QS75/40	3.00
QS92/1D	6.00
QS95/10	4.85
QS108/45	4.00
QS150/15	6.95
QS150/30	1.15
QS150/45	7.00
QS1200	3.95
QS1202	3.96
QS1203	4.15
QS1205	3.95
QS1206	3.95
QS1206	1.05
QS1207	0.90
QS1208	0.90
QS1209	2.00
QS1210	1.50
QS1211	1.50
QS1212	3.20
QS1213	5.00
QS1215	2.10
QS1218	5.00
QU37	9.50
QU37	11.50
QV03-12	4.95
QV05-25	1.75
QV06-20	29.50
QV2-250C	45.00
QV08-100	145.00
QY3-125	49.50
QY4-250	85.00
QY4-400	71.95
R10	4.00
R16	12.00
R17	1.50
R18	2.50
R19	2.50
R20	1.20
R1169	55.00
RG1-125	4.95
RG1-240A	14.50
RG3-250A	3.50
RG3-1250A	35.00
RK2K25	62.50
RG4-1000	10.00
RK-20A	12.00
RL16	1.50
RPL16	12.00
RPY13	2.50
RPY43	2.50
RPY82	2.50
RR3-250	15.00
RR3-1250	35.00
RS613	45.00
RS685	54.95
RS688	52.15
S6F17	5.95
S6F33	29.95
S11E12	38.00
S30/2K	12.00
S104/1K	10.00
S109/1K	15.00
S130	5.95
S130/P	5.95
SC1/800	5.00
SC1/1100	6.00
SC1/1200	5.00
SC1/1300	6.00
SC1/2000	9.00
SD6000M	45.00
SP2	1.50
SP4B	4.95
SP41	5.00
SP42	3.00
SS501	35.00
ST11	1.50
STV280/40	11.95
STV280/80	19.95
SU42	4.95
TB2 5/300	85.00
TB2-300	45.00
TB3/2000	395.00
TBL-2-300	275.00
TD1-100A	25.00
TD03-10F	35.00
TD3-12	4.00
TP25	1.50
TSP4	7.00
TT11	1.50
TT15	34.95
TT21	45.00
TT22	45.00
TT100	57.00
TTR-31MR	65.00
TY2-125A	85.00
TY4-400	70.00
TY8-600W	365.00
TYS2/250	375.00
U18-20	2.75
U19	11.95
U24	2.00
U25	0.90
U26	0.90
U37	9.00
U41	6.95
U50	2.00
U82	3.00
U191	0.70
U192	1.00
U193	0.65
U251	1.00
U801	0.75
UABC80	0.65
UAF42	1.00
UBF80	0.60
UBC41	2.95
UBC81	1.50
UBF89	0.60
UBL21	1.75
UC92	1.20
UCC84	0.70
UCC85	0.60
UCF80	1.00
UCH21	1.20
UCH41	2.50
UCH42	2.50
UCH81	0.65
UCL82	1.75
UF85	1.20
UF41	1.15
UF42	1.15
UF80	0.80
UF89	2.50
UL44	3.50
UL84	0.85
UU5	3.50
UU7	8.00
UU8	9.00
UY41	3.50
UY85	0.70
V235A/1K	250.00
V240C/2K	225.00
V241C/1K	195.00
V246A/2K	315.00
V339	3.50
VLS631	10.95
VP133	2.00
VR75/30	3.00
VR101	2.00
VR105/30	1.50
VR150/30	1.15
VT52	2.50
VU29	4.50
VU39	1.50
W77	5.00
W729	1.00
W739	1.50
X24	1.00
X66/X65	4.95
X76M	1.95
XC24	1.50
XC25	0.50
XFW47	1.50
XFW50	1.50
XG5-500	22.50
XL1-5V	1.50
XL628FT	7.50
XNP12	2.50
XR1-1600A	49.50
XR1-3200A	79.50
XR1-6400A	99.50
Y65	6.95
Y503	25.00
Y602	12.00
Y4070	130.00
YD1100	75.00
YJ1060	265.00
YL1020	29.00
YL1071	135.00
YL1290	65.00
Z77	1.20
Z303C	9.00
Z359	9.00
Z505S	15.00
Z520M	4.00
Z521M	8.00
Z700U	3.00
Z749	0.60
Z759	19.95
Z800U	3.00
Z803U	18.95
ZA1000	12.50
ZA1001	1.50
ZA1002	1.50
ZC1040	8.00
ZM1005	8.00
ZM1020	8.95
ZM1021	8.00
ZM1023	7.95
ZM1041	14.00
ZM1082	9.00
ZM1084	10.00
ZM1177	9.00
ZM1202	56.00
ZM1263	4.00
ZM1612	3.00
1A3	4.50
1AC6	1.20
1B3GT	1.95
1B22	10.00
1B24	14.95
1B35A	29.50
1BC2A	2.50
1C1	2.50
1C5GT	2.50
1D5	2.50
1FD1	2.50
1G3GT	2.50
1K3GT	2.50
1L4	0.60
1LA6	1.00
1N1	4.50
1N2	4.50
1P28	25.00
1N5GT	2.50
1P28	25.00
1S2	0.55
1S5	0.70
1T4	0.70
1U5	1.00
1X2B	1.40
1Z2	8.96
2B22	69.50
2C21	1.00
2C39A	23.50
2C39BA	39.50
2C40	37.00
2C42	29.50
2C51	0.75
2C53	32.00
2CY5	1.60
2B7	1.50
2D21	0.95
2D21W	2.50
2E26	7.95
2J42	93.00
2K25	24.95
2K25 Ray	75.00
2K26	95.00
3A108A	9.00
3A/107B	12.00
3A/109B	11.00
3A/110B	12.00
3A/141K	11.50
3A/147J	7.50
3A/167M	10.00
3A2	3.95
3A3A	3.95
3A4	1.10
3AL5	0.95
3AT2	3.35
3B2	3.00
3B4	7.00
3B7	4.50
3B24	10.00
3B26	24.00
3B28	12.00
3BZ6	1.50
3C4	1.00
3C45	24.00
3CB6	1.50
3CN3A	2.50
3CS6	0.95
3CY5	1.50
3CX3	2.50
3D6	4.50
3D21A	29.50
3D22	19.50
3E22	49.50
3EH7	1.95
3EJ7	1.95
3W4GT	2.50
4B32	35.00
4B551B	115.00
4BQ7A	1.75
4BZ6	1.95
4-65A	59.00
4-250A	65.00
4C27	25.00
4C28	25.00
4CB6	1.95
4CX250B ITT	37.50
4CX250B EIMAC	49.00
4CX250B Tested Ex Equipment	9.50
4CX250BM EIMAC	78.00
4CX250K EIMAC	95.00
4CX350A	71.50
4D26	75.00
4GS7	2.25
4GV7	2.25
4JC6A	2.95
4J52	78.00
4X150A	25.00
5A/102D	9.50
5A152M	9.00
5A163K	10.00
5A170K	6.25
5A-206K	10.00
5A-180M	9.00
4AM8	4.15
5AM8	2.15
5AN8	1.20
5AR4	2.00
5AU4	1.50
5B8	2.50
5B 110M	10.00
5B-254M	14.50
5B-255M	14.50
5B255M	19.50
5B/256M	9.00
5B-257M	9.00
5B-258M	14.50
5C22	89.50
5R4GB	2.80
5R4GY	2.80
5T4	5.95
5U4G	1.95
5U4GB	2.50
5V4G	1.25
5Y3GT	1.95
5Z4GT	0.85
6/30L2	0.70
6A/203K	9.00
6A7	4.95
6A8G	1.50
6AC7	2.00
6AF4A	2.50
6AF9	4.15
6AG5	1.50
6AG7	1.95
6AH6	2.50
6AJ4	2.00
6AJ7	2.00
6AK5	1.50
6AK6	2.50
6AL5	0.60
6AM4	3.25
6AM5	6.00
6AM6	1.50
6AN5	2.65
6AN8A	2.65
6AQ5	1.50
6AQ8	0.85
6AR8	3.95
6AS5	1.50
6AS6	2.50
6AS7G	4.50
6AT6	0.75
6AT8	1.75
6AU4	2.00
6AU6	0.95
6AV6	0.75
6AW8A	2.50
6B8G	1.50
6BA6	0.95
6BA7	4.50
6BA8A	3.50
6BC8	1.00
6BD4	1.50
6BD6	2.50
6BE6	0.72
6BF5	1.60
6BG6G	3.00
6BH6	1.95
6BH8	1.50
6BJ6	1.20
6BK4	4.00
6BK7A	1.95
6BL8	1.15
6BM8	0.58
6BN4	1.65
6BN6	1.65
6BN7	4.50
6BN8	2.35
6BQ5	0.75
6BQ7A	0.72
6BL7GTA	3.95
6BL8	1.15
6BR5	0.70
6BR7	4.95
6BR8	2.15
6BR8A	2.15
6BS7	5.50
6BW4	1.50
6BW6	5.35
6BW7	1.50
6BW8	4.00
6BX6	0.48
6BX7GT	3.50
6BZ6	2.50
6BZ7	2.95
6C4	1.10
6C5	1.95
6C6	2.50
6C8G	1.50
6C11	2.50
6C15	2.50
6C18	2.50
6CA4	3.50
6CA7	3.50
6CB5	3.95
6CB6	1.95
6CD6GA	4.50
6CF6	1.50
6CH6	6.95
6CL3	3.95
6CL6	3.25
6CL8A	2.00
6CM5	1.60
6CM7	2.95
6CS6	0.75
6CW4	6.50
6CY5	1.00
6DC6	2.95
6DK6	1.15
6DQ5	4.95
6DQ6B	2.50
6DW4	2.15
6EA4	4.95
6EA7	2.50
6EA8	2.50
6EB8	1.75
6EM5	2.50
6EM7	2.50
6EU7	£1.95
6EU8	1.75
6EV7	2.95
6EW7	4.50
6EW6	1.50
6F1	2.00
6F5	4.95
6F7	5.50
6F6G	2.00
6F12	1.50
6F13	3.00
6F14	1.00
6F17	2.75
6F21	2.50
6F22	0.70
6F23	0.60
6F24	1.25
6F25	1.25
6F28	1.25
6F32	1.25
6F33	17.00
6FG5	1.95
6FH8	12.50
6G6G	5.50
6GH8A	0.80
6GK5	1.50
6GK6	1.96
6GS7	2.15
6GV7	2.50
6GW6	2.50
6GW8	0.80
6H1	9.50
6H3N	1.10
6H6	1.95
6H6GT	1.95
6HS6	4.95
6J4	2.15
6J4WA	3.15
6J5	2.50
6J6	0.65
6JB6A	3.95
6JE6C	4.95
6JS6C	4.95
6JU8	2.50
6J7	2.50
6K7G	1.35
6K8Y	3.95
6KD6	5.50
6KM8	2.50
6KT8	2.95
6L1	2.50
6L19	3.95
6L6GC	2.95
6L6GC (GE)	3.95
6L6GT	1.50
6LD20	0.60
6LF6	4.50
6LJ8	2.50
6LQ6	4.95
6L15	3.18
6N7	2.50
6N7GT	2.50
6P15	1.50
6P25	4.00
6P26	4.00
6P28	2.00
6Q7	1.20
6Q7GT	1.20
6R7G	3.15
6S4A	1.50
6S7	1.10
6SA7GT	1.35
6SC7	1.50
6SG7	1.35
6SH7	1.35
6SJ7GT	1.35
6SK7	1.35
6SK7GT	1.35
6SL7GT	0.85
6SN7GT	1.35
6SQ7	1.35
6SS7	1.95
6U4GT	1.75
6U8	1.18
6U8A	1.50
6V6GT	1.15
6X2N	1.00
6X4	1.50
6X5GT	1.00
6X5GTY	1.00
6X8A	2.25
7A6	4.50
7A7	2.00
7AD7	1.75
7AU7	1.50
7B7	2.50
7C6	2.50
7E7	2.50
7J7	5.50
7V7	4.15
7Y4	2.50
8B10	2.50
8BQ5	1.95
8D8	2.50
8EQ7	1.95
85A8	1.50
10D2	1.25
10DE7	2.50
10F1	0.75
10GK6	1.95
10P14	2.50
10P18	0.70
10LD11	1.00
10LD12	0.65
11E3	55.00
12A6	3.95
12AD6	1.50
12AG8	1.50
12AL5	1.00
12AT6	0.95
12AT7	1.16
12AT7WA	2.50
12AU6	1.50
12AU7	0.55
12AV6	0.80
12AX4GT	1.00
12AX7	0.65
12AX7WA	2.50
12AY7	3.95
12AZ7A	1.95
12B4A	3.50
12BA6	1.50
12BE6	1.95
12BH7A	2.50
12BL6	1.75
12BY7A	2.75
12BZ6	4.95
12CA5	1.95
12CX6	1.20
12DQ6B	3.50
12DW4A	3.50
12DW7	2.50
12E1	17.95
12E14	28.00
12GN7	4.50
12HG7A	4.50
12J7GT	3.50
12K5	1.00
12K7GT	0.60
12K8	1.10
12SA7GT	1.00
12SG7	4.76
12SH7	1.00
12SK7	1.00
12SJ7	0.60
12SN7GT	1.85
12SQ7GT	1.50
12SR7	1.50
13D3	3.20
13D7	3.20
13D7	2.50
13D9	3.20
13DR7	2.95
13EM7	3.50
14S7	1.00
17EW8	0.95
17DW4	2.50
17DW4A	2.95
17JZ8	4.50
18D3	1.60
19AU4GT	2.50
19G3	17.00
19H4	23.95
19H5	33.50
19Q6	9.00
20A2	10.50
30D1	0.70
20LF6	3.50
20L1	0.95
20P1	0.55
20P3	0.60
20P4	1.95
20P5	1.15
21LU8	2.50
24B1	39.50
25L6GT	1.75
25BQ6	1.75
29C1	19.50
30C17	0.40
30C18	1.48
30F5	0.95
30FL1	1.00
30FL2	1.35
30FL12	0.95
30FL13	1.10
30FL14	1.25
30L1	0.45
30L15	0.60
30L17	0.80
30P4MR	1.00
30P12	1.00
30P18	0.60
30P19	1.00
30PL1	2.50
30PL13	0.50
30PL14	1.75
31JS6A	5.50
33A/158M	19.50
44A/158M	19.50
35A5	4.50
35L6GT	2.00
35W4	0.70
35Z3	1.85
38HE7	4.50
40KD6	5.50
42	6.95
4687A	9.50
47	6.00
60B5	1.60
50A5	1.50
50C5	0.95
50CD6G	1.15
50EH5	1.50
53CG	15.00
60JY6	2.96
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5886	13.95
6058	2.50
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6158	3.20
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7233	7.95
7239	17.50
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7462	15.00
7475	5.00
7486	75.00
7551	6.95
7558	9.45
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7587	26.95
7591A	4.95
7609	40.00
7788	18.50
7733	5.50
7868	3.95
803	14.95
805	39.00
807	1.60
810	45.00
811A	12.95
813	18.50
813 USA	45.00
829B	14.50
832A	14.50
833A	60.00
866A	4.50
872A	25.00
873	60.00
884	5.50
927	15.00
930	9.95
931A	13.95
954	1.00
955	1.00
958A	1.00
1299A	0.60
1619	2.50
1625	3.00
1626	3.00
1927	25.00
2050W	4.50
2050	3.95
3545	4.00
4313C	4.00
4328D	9.00
5642	9.50
5651	2.50
5654	1.95
5663	1.95
5670	3.25
5672	4.50
5687	4.50
5692	3.50
5696	2.75
5704	3.50
5718	6.15
5725	2.50
5726	1.50
5727	1.95
5749	2.50
5750	1.85
5751	2.95
5763	4.95
5814A	3.25
5829WA	6.50
5636	5.50
5678	7.50
5840	3.50
5842	11.00
5847	10.95
5879	8.50
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5894	39.50
5899	4.50
5963	2.00
5965	2.25
6005	1.85
5842	11.00
5894	39.50
5899	4.50
5963	1.75
5965	2.25
6005	1.85
6012	16.00
6021	3.65
6057	2.50
6058	3.95
6060	2.25
6062	4.50
6063	2.00
6064	3.25
6067	1.95
6072	4.20
6080	4.75
6080WA	8.50
6096	2.85
6132	10.00
6136	2.50
6146B	7.95
6157	2.50
6201	6.45
6211	2.50
6267	2.25
6350	2.00
7189	2.95
7247	2.95
7360	10.50
7475	5.00
7587	26.95
7591A	4.95
7609	47.00
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THE 11m CB TO 10m AMATEUR BAND CONVERSION GUIDE

PART THREE

A look at the PLL02 chip and modifications to the Colt 295 rig for ten metre amateur use

ROGER ALBAN GW3SPA
BSc. C ENG, MIEE

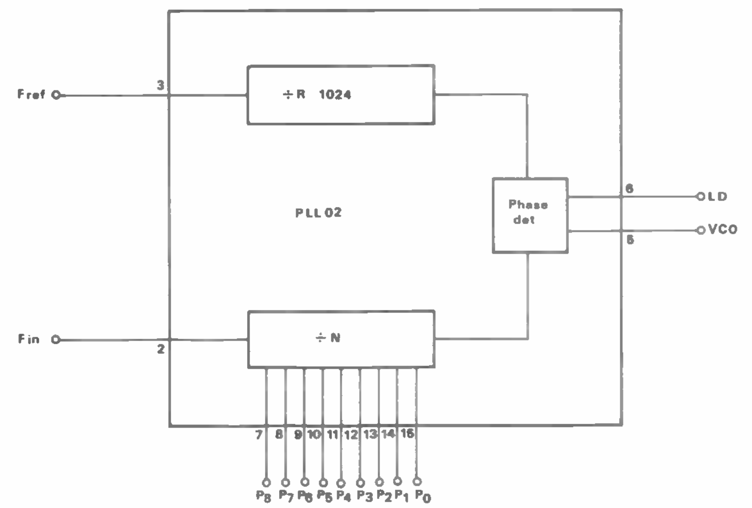

Fig 1 *PLL02 phase lock loop chip*

Another PLL used in the early days of American CB and adopted by the stable of Ham International and Colt is the PLL02 *(Figure 1)* which has a fixed reference divide of 1024 and a maximum divide-by-N of 511, similar to the Motorola PLL chip the MC145106. It is believed that the maximum '*Fin*' frequency is around 4.5MHz but if any reader has further information concerning this PLL chip the author would be pleased to receive it. The lock detector appears at Pin 6. The truth table is the same as given in December's article for a device with 9 program lines.

This PLL chip is used in the Colt 295 which uses three mixers and three crystal oscillators to obtain the correct VCO offset in frequency for both transmit and receive. The block diagram is shown in *Figure 2.* The frequency injected into the receiver first mixer is the sum of the VCO plus the loop crystal oscillator which ensures that the mixer injected frequency is above the receiver frequency, thus satisfying the normal

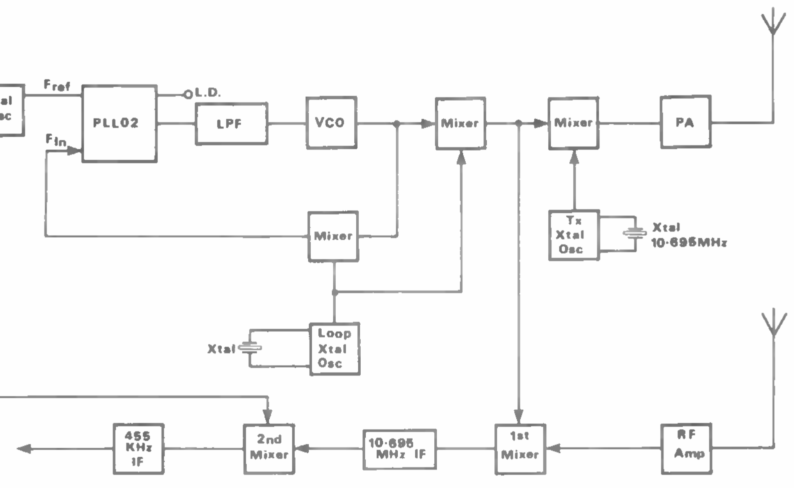

Fig 2 *Block diagram of Colt 295 American AM CB rig*

Function	P_8	P_7	P_6	P_5	P_4	P_3	P_2	P_1	P_0		
Pin No	7	8	9	10	11	12	13	14	15		
2^n	256	128	64	32	16	8	4	2	1		
Channel										÷ N	Frequency MHz
1	1	0	1	0	0	1	0	1	0	330	26.965
2	1	0	1	0	0	1	0	0	1	329	26.975
3	1	0	1	0	0	1	0	0	0	328	26.985
4	1	0	1	0	0	0	1	1	0	326	27.005
5	1	0	1	0	0	0	1	0	1	325	27.015
6	1	0	1	0	0	0	1	0	0	324	27.025
7	1	0	1	0	0	0	0	1	1	323	27.035
8	1	0	1	0	0	0	0	0	1	321	27.055
9	1	0	1	0	0	0	0	0	0	320	27.065
10	1	0	0	1	1	1	1	1	1	319	27.075
11	1	0	0	1	1	1	1	1	0	318	27.085
12	1	0	0	1	1	1	1	0	0	316	27.105
13	1	0	0	1	1	1	0	1	1	315	27.115
14	1	0	0	1	1	1	0	1	0	314	27.125
15	1	0	0	1	1	1	0	0	1	313	27.135
16	1	0	0	1	1	0	1	1	1	312	27.155
17	1	0	0	1	1	0	1	1	0	310	27.165
18	1	0	0	1	1	0	1	0	1	309	27.175
19	1	0	0	1	1	0	1	0	0	308	27.185
20	1	0	0	1	1	0	0	1	0	306	27.205
21	1	0	0	1	1	0	0	0	1	305	27.215
22	1	0	0	1	1	0	0	0	0	304	27.225
23	1	0	0	1	0	1	1	0	1	301	27.255
24	1	0	0	1	0	1	1	1	1	303	27.235
25	1	0	0	1	0	1	1	1	0	302	27.245
26	1	0	0	1	0	1	1	0	0	300	27.265
27	1	0	0	1	0	1	0	1	1	299	27.275
28	1	0	0	1	0	1	0	1	0	298	27.285
29	1	0	0	1	0	1	0	0	1	297	27.295
30	1	0	0	1	0	1	0	0	0	296	27.305
31	1	0	0	1	0	0	1	1	1	295	27.315
32	1	0	0	1	0	0	1	1	0	294	27.325
33	1	0	0	1	0	0	1	0	1	293	27.335
34	1	0	0	1	0	0	1	0	0	292	27.345
35	1	0	0	1	0	0	0	1	1	291	27.355
38	1	0	0	1	0	0	0	1	0	290	27.365
37	1	0	0	1	0	0	0	0	1	289	27.375
38	1	0	0	1	0	0	0	0	0	288	27.385
39	1	0	0	0	1	1	1	1	1	287	27.395
40	1	0	0	0	1	1	1	1	0	286	27.405

Fig 4 *Truth table for PLL02 phase lock loop chip used in American CB*

Fig 5 *Truth table for PLL02 phase lock loop chip used in modified 10m FM rig*

FUNCTION	P_8	P_7	P_6	P_5	P_4	P_3	P_2	P_1	P_0		
PIN NO	7	8	9	10	11	12	13	14	15	÷N	FREQUENCY MHz
2^n	256	128	64	32	16	8	4	2	1		
CHANNEL											
1	1	0	1	0	0	0	1	0	1	325	29.31
2	1	0	1	0	0	0	1	0	0	324	29.32
3	1	0	1	0	0	0	0	1	1	323	29.33
4	1	0	1	0	0	0	0	1	0	322	29.34
5	1	0	1	0	0	0	0	0	1	321	29.35
6	1	0	1	0	0	0	0	0	0	320	29.36
7	1	0	0	1	1	1	1	1	1	319	29.37
8	1	0	0	1	1	1	1	1	0	318	29.38
9	1	0	0	1	1	1	1	0	1	317	29.39
10	1	0	0	1	1	1	1	0	0	316	29.40
11	1	0	0	1	1	1	0	1	1	315	29.41
12	1	0	0	1	1	1	0	1	0	314	29.42
13	1	0	0	1	1	1	0	0	1	313	29.43
14	1	0	0	1	1	1	0	0	0	312	29.44
15	1	0	0	1	1	0	1	1	1	311	29.45
16	1	0	0	1	1	0	1	1	0	310	29.46
17	1	0	0	1	1	0	1	0	1	309	29.47
18	1	0	0	1	1	0	1	0	0	308	29.48
19	1	0	0	1	1	0	0	1	1	307	29.49
20	1	0	0	1	1	0	0	1	0	306	29.50
21	1	0	0	1	1	0	0	0	1	305	29.51
22	1	0	0	1	1	0	0	0	0	304	29.52
23	1	0	0	1	0	1	1	1	1	303	29.53
24	1	0	0	1	0	1	1	1	0	302	29.54
25	1	0	0	1	0	1	1	0	1	301	29.55
26	1	0	0	1	0	1	1	0	0	300	29.56
27	1	0	0	1	0	1	0	1	1	299	29.57
28	1	0	0	1	0	1	0	1	0	298	29.58
29	1	0	0	1	0	1	0	0	1	297	29.59
30	1	0	0	1	0	1	0	0	0	296	29.60
31	1	0	0	1	0	0	1	1	1	295	29.61
32	1	0	0	1	0	0	1	1	0	294	29.62
33	1	0	0	1	0	0	1	0	1	293	29.63
34	1	0	0	1	0	0	1	0	0	292	29.64
35	1	0	0	1	0	0	0	1	1	291	29.65
38	1	0	0	1	0	0	0	1	0	290	29.66
37	1	0	0	1	0	0	0	0	1	289	29.67
38	1	0	0	1	0	0	0	0	0	288	29.68
39	1	0	0	0	1	1	1	1	1	287	29.69
40	1	0	0	0	1	1	1	1	0	266	29.70

convention. The first IF frequency is 10.695MHz and the 10.24MHz obtained from the reference crystal oscillator is injected into the receiver 2nd mixer to arrive at a second IF frequency of 455KHz.

On transmit, the frequency injected into the receiver 1st mixer is injected into a transmit mixer where it is subtracted from the frequency of a crystal oscillator operating at the same frequency of the receiver first IF, to arrive at the transmit frequency. During receive the transmit oscillator is inhibited. The VCO is also fed to a down mixer connected to the loop crystal oscillator to ensure that '*Fin*' always remains below 4.5MHz, the maximum operating frequency of the PLL02 chip. Should the loop become unlocked the LD output from the PLL02 chip inhibits the transmitter; this is a common practice on the majority of CB sets.

Colt 295

The Colt 295 is designed as an 80 channel set in two groups of 40 channels and was designed to operate on the American forty channels of CB. Each group is selected by altering the frequency of the loop mixer crystal oscillator. The band switch on the front panel selects the two groups of channels, the low position selecting the American 40 AM channels, and the high position selecting the group of 40 channels higher. On the low channels the loop crystal oscillator is operating at a frequency of 20.48MHz, which in this set is derived from doubling the 10.24MHz reference oscillator frequency. On the higher channels the loop mixer crystal oscillator is operative at a frequency of 20.705MHz.

If you own one of these sets and require to convert it for 10 metre operation, the crystal in the loop mixer crystal oscillator will need to be exchanged for a 21.6275MHz crystal to ensure that channel 30 corresponds with the calling frequency of 29.6MHz.

The frequency table for the Colt rig is shown in *Figure 3.* It should be noted that Channel 1 10m FM corresponds to an operating frequency of 29.26MHz and not 29.31MHz as obtained from previous examples. The reason for this is that the American CB channels do not all correspond to a change of frequency in 10KHz steps. Certain frequencies are missed, and thus from *Figure 4* – right hand column – changing from Channel 3 to Channel 4 corresponds to a jump in frequency of 20KHz. Also note that in changing from Channel 23 to Channel 24 the frequency jumps back by 20KHz. In the Colt 295 this unconventional change in frequency can be amended.

Diode switching

The odd changes in the coding of the programming levels is obtained by diode switching after the channel switch, and these diodes can be re-arranged to give the required coding. *Figure 4* also shows the truth table for the logic that appears on the program pins of the PLL chip. By adding the 2^n for any given channel, one arrives at the divide-by-N number.

Figure 5 gives the required truth table, such that the operating frequency is incremented in 10KHz steps when the channel switch is incremented. A close examination of the two truth tables will reveal that the programme lines P_0 through to P_6 are altered by the channel change switch and that the other program lines remain unchanged. It is also usual to find P_8 permanently strapped to the positive supply voltage and P_7 earthed. Again by manipulating P_8 and P_7 it is possible to extend the operating range of the set, provided the loop remains locked.

Before replacing the loop oscillator crystal it is advisable to take the measurement of the phase detector voltage output from the PLL chip, Pin 5, with the set on Channel 19. Replace the crystal and retune the VCO inductive core until you obtain the same voltage reading on Pin 5, remembering to have the channel switch set on the High position. At this stage the loop should be locked.

All that remains to be done is to tweak up the transmitter coils and receiver RF amplifier. The Colt 295 is a handy rig because it contains an FM band which makes modifying this set relatively easy. For those of you who have obtained a set which does not contain an FM modulator/demodulator board, examples of providing this modification will be given later.

For repeater working the 100KHz offset can be obtained by changing the transmit oscillator crystal for a 10.795MHz crystal. The two crystals may be changed using a small relay operated from a switch on the front panel.

Binatone Route 66 rig

During the later half of 1981 a few manufacturers opted for a multi-purpose PLL chip designed rig to meet UK specifications for CB sets. One such set is the Binatone Route 66, which uses the PLL02 PLL chip. The Colt 295 used two mixers to ensure the VCO frequency operated at around 18MHz, whereas the Binatone Route 66 rig uses only one mixer in the loop circuit *(Figure 6)*. If Channel 20 is selected this corresponds to a UK CB frequency of 27.79125MHz, which corresponds to a VCO frequency of 38.48625MHz. One will note that the VCO frequencies in this rig are approximately double that of the Colt 295.

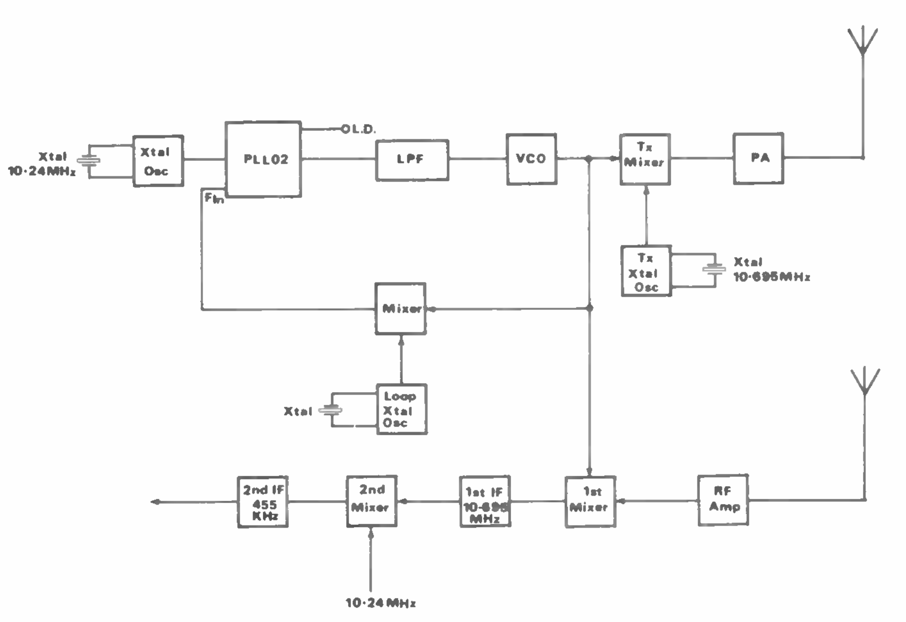

Fig 6 *Block diagram of a Binatone Route 66 UK CB rig*

CHAN	÷ N Ratio	CHAN	÷ N Ratio	CHAN	÷ N Ratio	CHAN	÷ N Ratio
1	168	11	178	21	188	31	198
2	169	12	179	22	189	32	199
3	170	13	180	23	190	33	200
4	171	14	181	24	191	34	201
5	172	15	182	25	192	35	202
6	173	16	183	26	193	36	203
7	174	17	184	27	194	37	204
8	175	18	185	28	195	38	205
9	176	19	186	29	196	39	206
10	177	20	187	30	197	40	207

Fig 7 *Divide-by-N ratios used in the Binatone Route 66 UK CB rig*

The mixer crystal oscillator operates at a frequency of 36.61625MHz corresponding to a 'F*in*' of 1.87MHz. With a reference frequency crystal of 10.24MHz and a divide-by-R ratio of 1024 the corresponding divide-by-N number for Channel 20 is 187. This again is different from the divide-by-N ratios used in the Colt 295 rig. *Figure 7* shows the various divide-by-N ratios used in the Binatone.

To convert this rig for use in the 10m band such that Channel 30 corresponds with the calling frequency of 29.6MHz, the loop crystal oscillator will need to be replaced and the rig re-tuned. From *Figure 7* the divide-by-N ratio for Channel 30 is 197, corresponding to a 'F*in*' of 1.97MHz.

For a transmit frequency of 29.6MHz the VCO will be required to operate at 40.295MHz, and therefore the mixer oscillator frequency required is 40.295MHz − 1.97MHz or 38.325MHz. For repeater working the 100KHz transmit frequency shift can be obtained by changing the Tx mixer crystal oscillator as previously described.

Fig 3 *Frequency table for the Colt 295 rig*

Mode of operation	Operating Frequency MHz	Frequency at first mixer MHz	Xtal Osc MHz	VCO MHz	'F*in*' MHz	÷N
AM CB chan 1	26.965	37.66	20.48	17.18	3.3	330
AM CB chan 30	27.305	38.00	20.48	17.52	2.96	296
AM CB chan 40	27.405	38.10	20.48	17.62	2.86	286
10m FM chan 1	29.26	39.955	21.6275	18.3275	3.3	330
10m FM chan 30	29.60	40.295	21.6275	18.6675	2.96	296
10m FM chan 40	29.70	40.395	21.6275	18.7675	2.86	286

Next month

Next month I will be looking at the dedicated PLL chips used in American CB rigs to prevent the equipment from being modified to operate on frequencies other than the American CB channels, and how to get around this obstacle.

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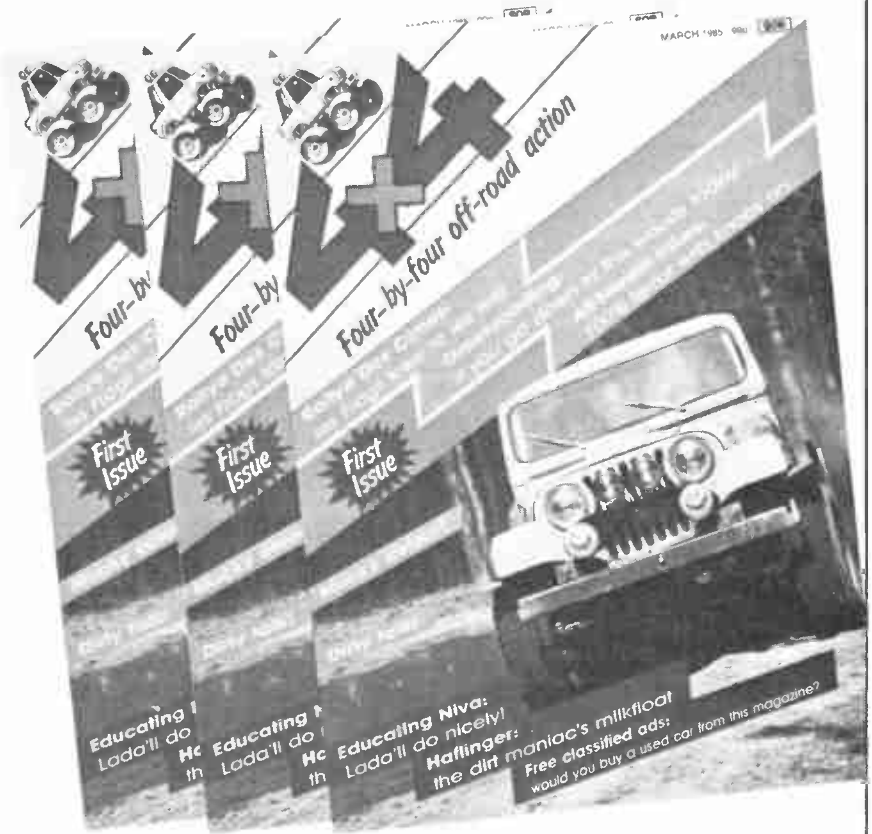

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PART 5

Impedance matching explained and a look at aerial forms

A further point of discussion is the contentious one of standing wave ratios. SWR is one of the most misunderstood and misquoted expressions used in amateur radio. It is basically an indication of the degree of mismatch appearing between a source of RF energy and the load to which it is applied.

In March 1956, a classic article appeared in *QST* and the subject is as relevant today as it was then. The heading was *'My Feedline Tunes My Antenna'* and the article went on to discuss the effects of mismatch on an aerial installation.

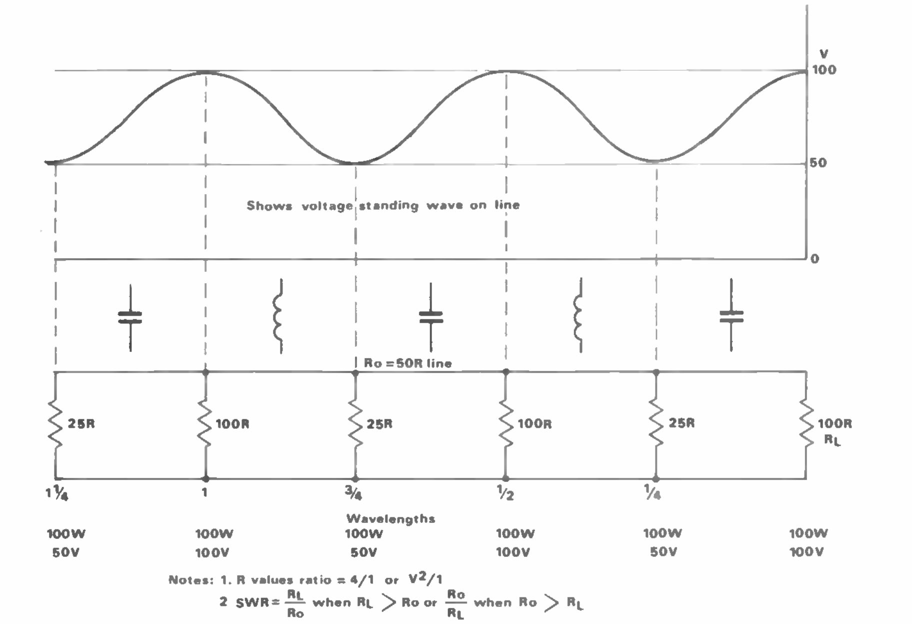


***Fig 1** Showing effect of mismatched load on line*

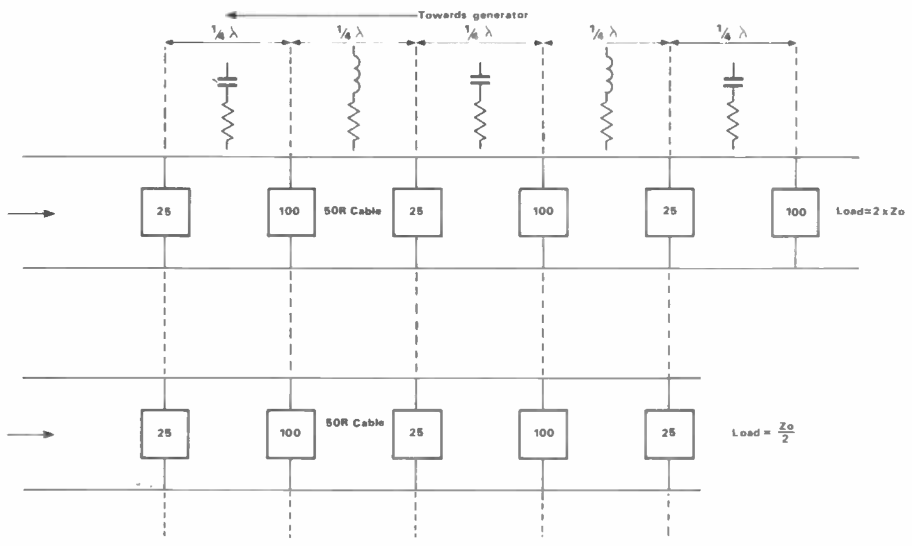


***Fig 2** The original diagram which appeared in QST April 1977*

A favourite question in the RAE requires the student to differentiate between the resistive loading of quarter or half wave sections of a coax line. Unless a line is perfectly matched resistance-wise to its characteristic impedance, variations in the impedance will appear along the line.

Figure 1 shows this effect in greater detail, the important fact being that at quarter wave intervals a purely resistive load will appear with the spacing between these loadings varying either as a capacitive or inductive reactance. The relative order in which the two values appear is determined by the relationship between the optimum load and the applied load. If the impedance of the applied load is higher than the characteristic impedance, the first section of the line will be capacitive whereas the reverse applies if the load is lower than Z_0.

Figure 2 is the classic diagram which appeared in *QST* when the article was reprinted in April 1977. Theoretically, the characteristic impedance of a transmission line is that value of resistance which when used to terminate the line makes the input impedance independent of the electrical length of the line.

This is not strictly true, since the losses shown in any one line are a function of length and will show a gradual variation in input impedance as a cumulative effect of series resistance (and, to a limited degree, the effect of impedance variation due to the different R and X relationship along the line).

First principles

From first principles, in order to achieve a perfect match the voltage or current must be constant in value along the line. As can be seen in *Figure 2*, this is not possible in a mismatched line since as the resistance and reactance vary along the line, so must the voltage and current.

By taking examples from the original article and referring to the upper of the two examples shown, let us assume we are putting 100 watts into the 100ohm load.

The current at that point will be one ampere and the voltage 100V. At a quarter wave back along the line the resistance is 25ohms and from I^2R we find that the current is now 2 amps and the voltage 50V. At the half wave point we are back to our starting point.

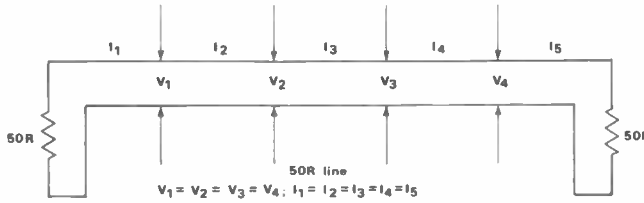
This variation in current and voltage along the line gives us our variations in standing wave values, and the ratio between the current maximum and minimum or voltage maximum or minimum is the SWR. In this case the ratio is 2 to 1 so we say the SWR is 2:1.

One rather important feature is that this is also the square root of the ratio of the two resistive values. The maximum SWR is the ratio of the two voltage valves measured at successive quarter wave intervals, but can be measured at other points with reduced values for specific frequencies. Obviously the calculations can be further complicated by the presence of reactance in the circuit.

The 'experts' who adjust the length of the line to get resistive points and lower SWR values are only making things easier to couple into, they are *not* affecting the load value. The only method of varying the SWR satisfactorily is to adjust the load to an optimum value. All other techniques are basically compromises.

One important feature to remember is that all power that enters a line can only leave via the aerial. A high SWR at the aerial, consistent with a low value at the Tx, is an indication of losses in the line and can be simply demonstrated by estimating the SWR at the Tx end, and introducing the loss factor of the line.

For example, a length of RG 58/U of 65ft, feeding an aerial on 21MHz, would have a matched loss of 2dB per 100ft, or 1.6dB per 65ft. If we measured the SWR at the transmitter it would not represent a true reading as we should really take the reading at the point of connection to the aerial.



Matched circuit giving no line variations

Because of line loss, we tend to see more forward power at the Tx than at the aerial, and also less reflected power at the transmitter than at the aerial. These two factors in combination give a totally false impression of the true state of affairs at the aerial, and the greater the line loss the worse the effect of this variation.

Figure 3 shows the true values of aerial SWR for measured values at the Tx for various line losses. Taking our 21MHz example, we find that a 2.0 value at the Tx is almost 3 at the aerial. Some of the fraternity will immediately go into a state of panic at an SWR value of 3:1, but what does it mean in actual power loss?

From *Figure 3* we can set our line loss against our SWR and find the additional loss, which amounts to some 0.6dB. By adding all the losses we arrive at about 1.9dB. If we replace the cable with RG8 we gain about 0.8dB, hardly worth it at 21MHz. The same calculation carried out at 145MHz or 432MHz is very illuminating. The appendix to this series published next month will show the relationship between power and expanding wave ratios.

Matching

Most transistorised output stages are designed to work with SWR values of 2:1 or less. Higher SWR values can create high values of current and voltage in the output networks, and in some cases can cause damage to output devices, or voltage breakdown of capacitors, or even overheating of coils.

It is advisable to use some form of impedance matching network in the form of a matching device sufficient to enable the Tx to operate within safe limits, but this does not mean that an inefficient aerial will now be made efficient, only that more power is transferred into it.

The secret is to match the aerial itself to become a perfect substitute for the purely resistive load equal to the

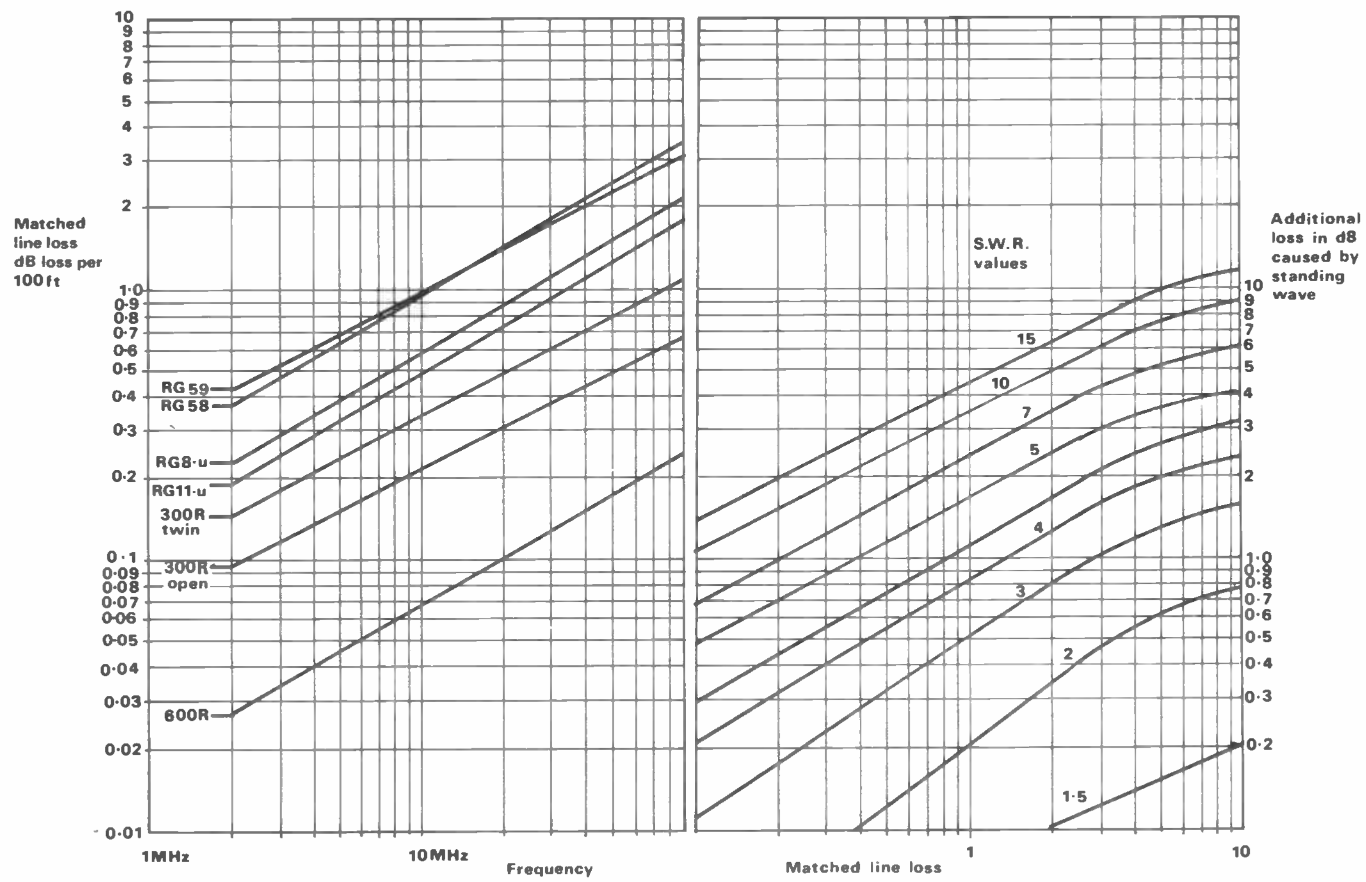


Fig 3 *Losses due to feed lines*

characteristic impedance of the feeder, thus ensuring maximum transfer of power to the radiator. This can preferably be done at the aerial end of the feeder, thus eliminating feeder losses.

Aerial forms

It is outside the scope of this presentation to discuss aerial forms in detail. The radiation patterns of simple wire aerials are shown in the appendix, in a later article, and attention is drawn to the basic principle of the co-linear aerial. By effectively using three half wave sections in series and folding the centre one back into itself the phase of the resultant output fields is additive, and becomes more concentrated, consequently giving gain in a reduced vertical dimension.

This aerial used in a vertical configuration gives less radiation in a skyward direction and more into a horizontal plane, and so is very popular on VHF FM. The effect of a similar arrangement using horizontal dipoles, fed out of phase at selected parallel spacing, can also give gain in a selected direction.

By feeding one aerial only and varying the electrical length of a similar aerial a small fraction of a wave length away, a suitable phase distribution, which can be additive or subtractive, can be achieved. Thus a forward gain, in which one element acts as a reflector and the other as a director without direct power being fed into them, is created. Such elements are called parasitic elements. This is the Yagi UDA aerial, known generally as the Yagi.

The so called $5/8$ aerial is basically a shortened $3/4$ wave in which the $1/8$ wave is absorbed in an inductive reactive circuit to compensate for the capacitive reactance present in the shortened aerial. The two reactances cancel and effectively present an 80ohm resistive load to the feeder of the $5/8$ physical length.

From the points discussed it should be obvious that an aerial which is end fed and is one half wave long will be fed at a voltage or high impedance point. Simply, this can be fed from the top of a parallel tuned circuit (high dynamic resistance). An aerial that is only a quarter wave length will be current fed, and will need to be fed from a low impedance source on the top of a series resonant circuit (maximum current, low impedance). These are also shown in the appendix, next month.

The voltage fed aerial is shown as a Hertzian aerial, and the current fed as a Marconi. The effect of the height of an aerial above ground is significant since a radiated wave travelling from the aerial to the ground and reflecting back through the aerial will induce currents back into the radiator.

If the aerial is one half wave above ground or a whole number of half waves high, then the reflected wave will travel a whole number of full waves before it returns to the aerial (aerial – ground – aerial), thus it will be in phase with aerial currents and have no effect on current distribution. Any other height will have a varying effect on the phase relationship in the aerial and will have a marked control over the radiation resistance, and consequently the matching impedance.

The objective of this series of articles has been to present a relatively simple explanation of the performance of aerials and propagation for RAE students and others. The presentation has far exceeded the exam requirements in many sections, but this has been purposely carried out to enable a proper understanding of the subject to be created and to clarify many conflicting arguments heard over the air. Obviously, such a wide subject can only be glossed over and it is hoped that sufficient meat has been left attached to the bare bones to create a satisfying meal.

Appendix

Next month's appendix gives a more theoretically applied slant to certain comments without being too advanced. Probably the most conclusive studies of aerials suitable for the beginner are those by Bill Orr W6SAI, obtainable at most rallies from the RSGB bookstall.

COMING NEXT MONTH

Amateur RADIO

ANGUS McKENZIE G3OSS
reviewing the new Microwave Modules MMT144/28R
2m transverter

RECEIVER SPECIAL
a survey of recent reviews and how to align older receivers

CONTEST CALENDER
Nigel Cawthorne G3TXF with a look at contests in 1985

THE DREADED DECIBEL
J Glanville G3TZG with the theory behind the unit

Plus DX Diary, On the Beam, SWL, Back to Basics, Straight and Level, your letters and features covering the whole of amateur radio

DON'T MISS the March issue – on sale 28 February
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COMING NEXT MONTH

BACK TO BASICS

Bill Mantovani G4ZVB continues his common-sense approach to passing the RAE. This month:

RADIO RECEIVERS

This month it's time to get down to the nitty-gritty on radio receivers. For those of you who have done their homework since the January issue of *Amateur Radio*, understanding Chapter 4 of the *Radio Amateurs' Examination Manual* should prove fairly straightforward, so let's begin by looking at certain terms used in connection with radio receivers *(see table)*.

The *sensitivity* of a particular receiver is a measure of its ability to receive weak signals, sometimes so weak that they barely stand out from the background noise on a particular band. As explained, a receiver's sensitivity is usually quoted as being that level of signal at the antenna input which will produce a standard ratio of signal-to-background noise. Therefore, if a receiver's sensitivity is said to be 1μV for 10dB signal-to-noise ratio, this means that the level of the signal (1μV) will be about three times the level of the noise present with the antenna removed and the input correctly terminated.

Sensitivity – indicates the ability of a receiver to receive weak stations.
Selectivity – is the ability of a receiver to receive one particular signal whilst ignoring others on adjacent frequencies which may often be much stronger.
Dynamic range – a wide dynamic range allows the receiver to cope with both strong and weak stations that may appear together on similar frequencies.
Bandwidth – if a receiver has high selectivity it is said to have a narrow bandwidth.
Automatic gain control – (agc) is where the strength of the incoming signal is used to automatically control the sensitivity of a superhet receiver, giving a fairly constant audio output.
Frequency stability – is the ability of a receiver to remain tuned to the desired signal without drifting off-frequency.

Winkle out weak DX

Communications receivers, as amateur receivers are often called, should ideally have very good sensitivity to allow the operator the best possible chance of winkling out that weak DX signal but at the same time, a receiver must also be able to cope with extremely strong signals from stations much closer to home. The sensitivity of a communications receiver can thus usually be varied by the operator by means of an RF gain control, or the facility can be built into the receiver circuitry as *automatic gain control* (agc). Amateur receivers will normally employ both methods.

Agc allows the sensitivity of a receiver to be controlled automatically according to the strength of the signal being received. If the signal is strong, then the sensitivity of the receiver will be reduced automatically (as high sensitivity is unnecessary), but if the wanted signal is extremely weak then the agc circuit will increase the receiver's sensitivity to a high level. Agc is also useful if the signal suffers from fading (QSB, as it is referred to in the Q-code). The agc circuitry tries to vary the sensitivity in accordance with the incoming signal to produce an almost constant, fade-free signal for passing on to the detector stage. A receiver that is able to cope equally well with very strong signals and very weak ones is said to have a good *dynamic range*.

Crowded

On today's crowded amateur bands, stations often have to operate on frequencies that are very close to each other, thus making it difficult for an amateur to work a particular station without experiencing considerable interference from other signals. A receiver should therefore have good *selectivity*, that is, its selectivity must be high enough to allow the reception of the desired signal, whilst at the same time disregarding signals on adjacent frequencies and so minimising the amount of adjacent channel interference.

Bandwidth

The *bandwidth* of a receiver is closely linked with selectivity. If a receiver has a high selectivity it is said to have a narrow bandwidth but at the same time there are constraints which do not allow the bandwidth to be too narrow, and which thus place a limit on a receiver's usable selectivity. This limit is governed by the bandwidth of the type of signal which is being received. In practice, for communications-quality speech in a double sideband (DSB) system a bandwidth of about 6KHz is required, whilst for single sideband (SSB) speech a bandwidth of half this figure is adequate. A bandwidth narrower than this would result in a loss of some of the speech component of the transmitted signal, so that the received signal begins to sound unintelligible.

For CW, at manual keying speeds, the bandwidth can be reduced even further at the transmitter end to between 100 – 300Hz. However, the *frequency stability* of the oscillator stage in the receiver (and transmitter) could cause the receiver tuning to drift if the receiver bandwidth were any less than the above figures, possibly losing the station being worked altogether. Ideally, the receiver should be able to receive just the right bandwidth for any mode, so provision is made in modern communications receiver designs to switch the bandwidth to the correct level for each particular mode of reception by means of filters.

Tuned radio frequency receiver

For the RAE we are interested in two basic types of receivers, the tuned radio frequency or TRF receiver and the superheterodyne or superhet receiver. In the early days of radio, TRF receivers were widely used by amateurs and consisted, briefly, of a regenerative detector followed by one or more stages of AF amplification. At the front end, a tuned RF amplification stage would be added to improve the sensitivity of the 'straight' receiver, hence the name TRF. This basic design of receiver has limited characteristics so today its appeal is restricted more to the beginner, for whom it can be a particularly good constructional project and also a useful basis for the study of far more complex circuits. A block diagram of a simple three-stage TRF receiver is shown in *Figure 1*. Let us now look at the three stages a little more closely.

RF amplifier

The purpose of the RF amplifier is to increase the sensitivity and selectivity of the receiver. It also isolates the antenna from the following detector stage and stops it from affecting the correct operation of the detector. The incoming RF signal is amplified before being passed to the detector stage but further improvements in sensitivity may be achieved by the use of additional RF amplifier stages. The amount of RF amplification should not, however, be so high as to cause instability in the receiver.

The detector stage

The function of the detector stage in a TRF receiver is two-fold: to convert the radio frequency signal to an audio signal and to generate a degree of feedback for the reception of CW.

The AF amplifier

The AF stage simply amplifies the audio frequency output from the detector and drives headphones or a loudspeaker, the amount of AF amplification being varied by means of a gain control. The complete circuit of a three stage TRF receiver is shown in the RAE manual together with a description of how it works. Tr1 is the RF amplifier, Tr2 operates as a detector (with the feedback for CW reception being adjusted by means of the 300pF variable capacitor connected to the drain), and Tr3 is the AF amplifier. FETs are used for Tr1 and Tr2, whilst the transistor Tr3 is connected in a simple common-emitter amplifier circuit. You should understand the basic operation of this fairly simple receiver circuit before moving on to the more advanced superhet receiver.

A note first about the term *bandspread.* Tuning of the TRF receiver shown is by means of two sets of ganged variable capacitors. The high value capacitors are used to tune the RF stage and the detector stage, whilst the smaller value variable capacitors connected across these main tuning capacitors serve to allow a small portion of the tuning range of the main capacitors to be spread over the whole range of these smaller bandspread capacitors, thus making tuning on the crowded bands somewhat easier.

Superhet receivers

The block diagram of a simple superhet receiver *(Figure 2)* shows that the superheterodyne principle utilises somewhat more stages than the TRF receiver. A superhet receiver offers considerable improvement in selectivity and an increase in gain over the straight TRF receiver, and operates as follows.

The frequency of the received signals is first converted to a single, fixed frequency called the *intermediate frequency,* which is usually fairly low. It is at this IF that all of the receiver's selectivity can be obtained together with most of the gain, because the IF amplifier (or amplifiers) only need to be tuned to one set frequency, and once correctly adjusted can be left alone. Hence, the circuits can be designed to achieve a high amplification factor whilst retaining good stability.

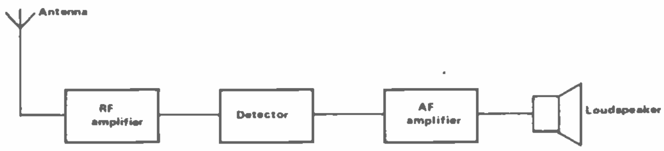


Fig 1 *A three stage TRF receiver block diagram*

The majority of *Chapter 4* now discusses in greater detail the purpose and function of each separate stage of the superhet receiver, but this article will concentrate on the points most relevant to the RAE syllabus. Do make sure that you read the chapter carefully and understand the basic design principle of the superhet receiver, because there will certainly be a number of questions on this topic in the exam. Remember, also, that it is the *principle* of the superheterodyne receiver that you are required to understand: you will not be asked to explain the workings of each stage in minute detail as some candidates have thought!

The superhet principle

This is the basic superheterodyne principle of reception, which you should become familiar with. The frequency of the incoming signals is converted to a fixed intermediate frequency by a frequency mixing process performed by the aptly named *mixer* stage. Here, the incoming signal frequency is mixed with the output of the *local oscillator,* whose frequency is varied by the receiver's tuning control. The process produces two frequencies at the mixer output (see *Figure 3a*), one being the sum and the other the difference of the local oscillator and signal frequencies.

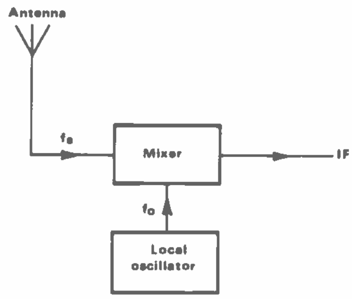
Only one of these frequencies will be accepted by the following IF stage (that to which the IF amplifier is tuned), whilst the other is rejected. This intermediate frequency is then amplified and fed to the detector stage, which converts it to an audio frequency for amplifying in the AF stage (just as it does in the TRF receiver).

In order to compensate for variations in the level of the received signals, the gain of the receiver is varied as necessary by the *automatic gain control* (agc). The agc stage is connected to the output of the IF amplifier, from which it produces a voltage whose amplification is proportional to the amplitude of the incoming signal. This voltage is then used to control the gain of the IF stage.

BFO

For the reception of *continuous-wave* telegraphy (CW) signals a *beat frequency oscillator* (BFO) is used to provide a signal which will beat with the IF and so produce an audible beat note. The BFO is very loosely coupled to the detector, operates at the intermediate frequency and is variable either side of this frequency by a few KHz to give an audible note that is acceptable to the listener.

Let us now look at one or two problems that are associated with the design of superhet circuits.



$IF = f_o + f_s$ *or* $f_o - f_s$

Fig 3a *The mixer process*

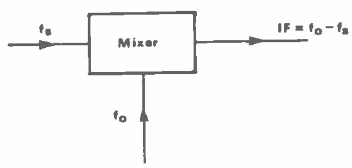


Fig 3b *How the wanted signal produces the correct IF*

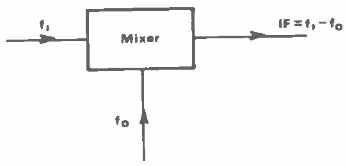


Fig 3c *How the image frequency also produces the correct IF*

Fig 2 *Block diagram of a simple, single-conversion superhet receiver*

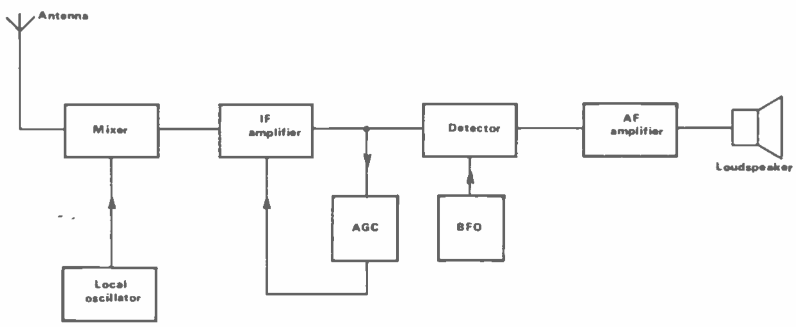
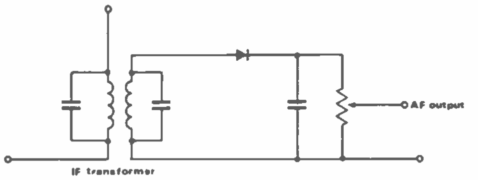


Fig 4a Basic diode detector circuit



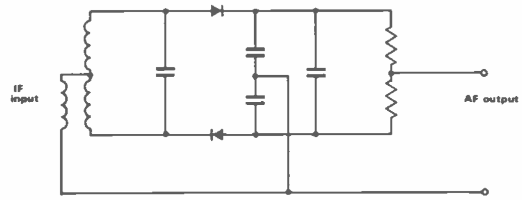


Fig 4b Basic ratio detector circuit

As previously mentioned, two frequencies appear at the output of the mixer stage but only that which matches the intermediate frequency will be accepted by the IF amplifier; the other is rejected. However, it is not just the wanted signal frequency which can mix with the local oscillator frequency to produce a signal at the required IF. As the example on page 38 of the *RAE Manual* shows, it is quite possible for there to be a very strong signal present on a frequency other than that to which the receiver is tuned which can also mix with the local oscillator frequency to also produce the correct IF. This is shown more readily in *Figures 3b* and *3c*.

The unwanted signal which has also produced the correct IF is called the *immage* or *second-channel* frequency and makes it sound at the audio output as if the receiver were picking up two signals simultaneously on the same frequency. The interference caused, only occurs when the second channel signal is strong enough to operate the mixer. This can happen if there is no RF stage present to isolate the antenna from the mixer, or when the mixer stage is inadequately screened. Remember that the image or second-channel is numerically twice the intermediate frequency away from the wanted signal, so that if the IF were increased then the incidence of image interference would be reduced. We shall look at how this is done in practice in a moment.

The local oscillator (LO) needs to have good frequency stability otherwise the receiver will appear to drift. Usually, the frequency of the local oscillator will be on the high side of the signal frequency. The LO tuned circuit must maintain a frequency separation equal to the intermediate frequency over the mixer tuned circuit throughout the receiver tuning range. This is known as *tracking*.

The RF amplifier

As with the TRF receiver, an RF amplifier stage can be employed in a superhet circuit to improve the sensitivity, and hence the signal-to-noise ratio, of the receiver. The RF amplifier also serves to reduce the chance of second-channel interference, and its tuning is ganged to the mixer/local oscillator control.

The IF amplifier

Typically, a superhet receiver can have one, two or even three stages of IF amplification. The IF amplifier circuit is based around a tuned circuit which responds to one frequency only and the selectivity of an IF amplifier is solely determined by the design of the coupled tuned circuits of the *IF transformer*. Study Figure 4.8 in the *RAE manual* to familiarise yourself with selectivity curves and the terms *nose* width, *skirt* width and *shape factor*.

Typical IF values in use today are between 455-470KHz for receivers that operate up to 30MHz. Remembering what was said at the beginning of this article about optimum bandwidth for a particular reception mode, it is possible to reduce the bandwidth by reducing the value of the IF. This will increase the chances of second-channel interference, but good selectivity and second-channel performance can be achieved by the use of two different IF frequencies. This is called the *double superhet* and it gives very good performance indeed. A high first IF is used to ensure minimal second-channel interference, whilst a low second IF makes for good selectivity and a narrow bandwidth.

Another way to achieve better IF selectivity is to use a *bandpass filter* of which two typical types are the crystal filter and the mechanical filter. The former is useful when receiving CW due to the narrow nose bandwidth, whilst the latter is normally used for suppressing the unwanted sideband in a single sideband transmitter.

The detector

This demodulates the output of the IF amplifier to recover the modulation that was superimposed on the carrier at the transmitter. The AF output from the detector is fed to a conventional audio amplifier and converted into sound by headphones or a loudspeaker. The use of a BFO to resolve CW signals has already been covered.

The most common form of detector is simply a diode acting as a half-wave rectifier, the output being developed across the diode load resistor as shown in *Figure 4a*. The above is called the *diode* or *envelope detector* and is used for the reception of amplitude-modulated (AM) and CW signals. For the detection of frequency modulated (FM) signals, the ratio detector circuit of *Figure 4b* is often used. Make a note of the circuits in *Figures 4a* and *4b* as a typical RAE question could be to state the use of a particular detector circuit, or to simply state which is a detector circuit from the choice given. There are such questions in the sample papers at the back of the *RAE Manual*.

In order to be able to resolve SSB signals it is necessary to insert a signal into the detector to replace the carrier wave which was suppressed in the transmitter. A *carrier insertion oscillator* is used for this purpose, but the function can also be performed by the BFO to some degree. The preferred circuit for the resolution of an SSB signal is the product detector, which can also be used for the resolving of CW. That is about it on receivers, save to mention some other features often found in receiver designs.

The crystal-controlled *calibration oscillator* provides a calibration marker every 100KHz (typically) throughout the tuning range of the receiver, so that the scale can be accurately adjusted. A *noise limiter* is often included to try to reduce any electrical noise which may be causing interference. Certain other noises, such as the infamous "woodpecker", also cause havoc with reception, but by employing a circuit which limits signals which exceed a particular modulation level it is sometimes possible to reduce this interference.

Most, if not all, communications receivers now come equipped with a *signal-strength* or S-meter to give an indication of the strength of the incoming signal. The meter is calibrated in S-units but as there is no agreed definition of an S-unit, the readings are only really of use with reference to other signals being received.

We have now discussed the basic principle of the superhet receiver; to convert incoming signals to a fixed IF followed by demodulation and audio amplification. It is possible to convert the received signal directly to AF, a principle known as *synchrodyne* or *direct conversion*, but problems with oscillator stability tend to confine this type of receiver to lower-frequency amateur bands.

The principles we have discussed also apply to receivers which cover the VHF and higher frequency ranges, although the IF will usually be much higher and its bandwidth greater. Next month: transmitters.

Acknowledgements and references

Radio Amateurs' Examination Manual – GL Benbow, G3HB (RSGB)
A Guide to Amateur Radio – Pat Hawker, G3VA (RSGB)
City and Guilds of London Institute.
Radio Communication Handbook (fifth edition) – RSGB
How to pass the Radio Amateurs' Examination – George Benbow, G3HB (RSGB)

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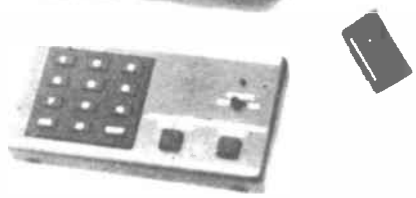

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This range includes the IC-271E-25W, 271H-100W and the 70cm versions IC-471E-25W and 471H-75W r.f. output. The 271E has an optional switchable front-end pre-amp. The 271H has a mast-head pre-amp AG-25, and the 471E and 471H use the AG35 mast-head pre-amp. Other options include internal switch-mode PSU's: the 271E and 471E use the PS25 and the 271H and 471H use the PS35.

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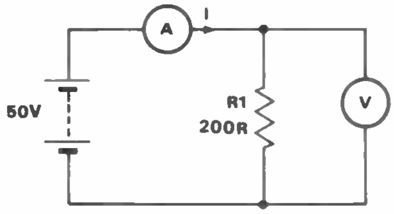
QUESTIONS & ANSWERS

RAE PRACTICE DEVISED BY R.E.G. PETRI G8CCJ

Fig 1

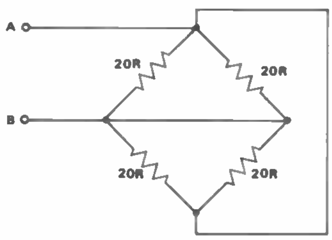


1. Which one of the following formulae would you use to calculate the current 'I' flowing in the 200ohm resistor R1?
   (a) I=V/R
   (b) $I=V^2/R$
   (c) I=R/V
   (d) $I=V^2R$

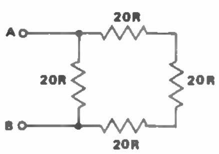
2. You are asked to calculate the power dissipated in the 200ohm resistor R1 *(Figure 1)*. Which one of the following formulae would you use?
   (a) W=VI
   (b) $W=R^2/V$
   (c) $W=V/R^2$
   (d) W=R/I

3. Referring to *Figure 1*, what is the current 'I' flowing, and the power dissipated in the 200ohm resistor R1?
   (a) 50A/200W
   (b) 0.25A/12.5W
   (c) 5A/20W
   (d) 2.5A/125W

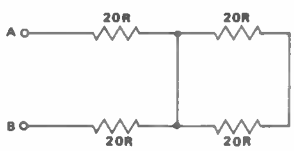
Fig 2



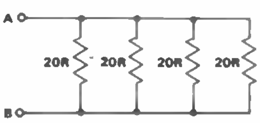
4. You are presented with a jumble of resistors which appear to be connected as shown in *Figure 2*. Which one of the circuit arrangements shown below will put this jumble into a simple form for easy calculation?



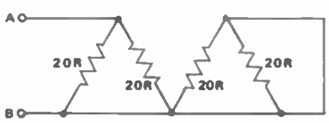
(a)



(b)



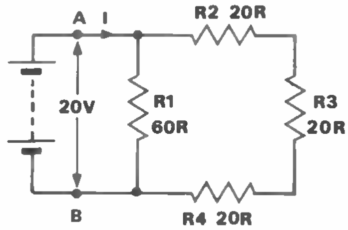
(c)



(d)

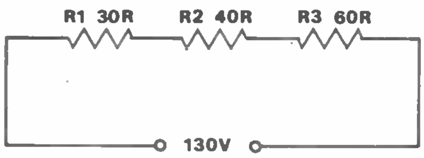
5. What is the total resistance of the circuit shown in *Figure 2*, measured across terminals A & B?
   (a) 15Ω
   (b) 40Ω
   (c) 5Ω
   (d) 10Ω

Fig 3



6. *Figure 3* shows a series/parallel resistor combination. What resistance does this circuit present to the battery at terminals A & B, and what is the total current 'I' flowing from the battery?
   (a) 120Ω/20A
   (b) 20Ω/1.20A
   (c) 30Ω/6.66A
   (d) 30Ω/0.66A

Fig 4



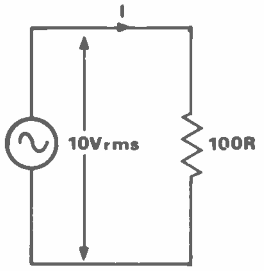
7. A 130 volt supply is applied across the three series connected resistors shown in *Figure 4*. What potential difference would you measure across R1, R2 & R3 respectively, when using a high resistance voltmeter?
   (a) 30V, 40V, 60V
   (b) 60V, 40V, 30V
   (c) 15V, 20V, 30V
   (d) 30V, 20V, 15V

8. The frequency, 'f' hertz, of an alternating current or voltage is determined by:
   (a) the maximum amplitude of the waveform
   (b) the minimum amplitude of the waveform
   (c) the number of complete cycles of the waveform that occur in one second
   (d) the number of 'zero crossings' in one hour

9. An alternating current has a peak value of 325 volts. What are the peak-to-peak and rms values?
   (a) 230V/115V
   (b) 650V/230V
   (c) 650V/325V
   (d) 495V/230V

10. *Figure 5* shows a 10V rms alternating supply connected across a pure resistance of 100Ω. What is the rms current?
    (a) 0.1A
    (b) 1A
    (c) 10A
    (d) 100A

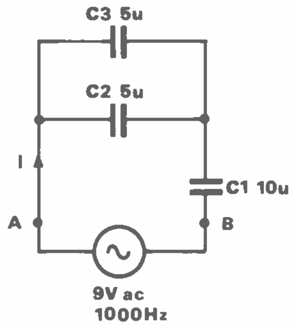
Fig 5



11. Referring to *Figure 5*, it may be said that:
(a) current does not flow in the resistor when the voltage is at maximum
(b) the voltage is at minimum when the current flowing is at a maximum
(c) the voltage and current are in phase
(d) the voltage and current are in anti-phase

12. Reactance is the term given to the ability of an inductor or capacitor to:
(a) amplify an alternating current
(b) magnify an alternating current
(c) resist the flow of an alternating current
(d) compensate for circuit losses

Fig 6



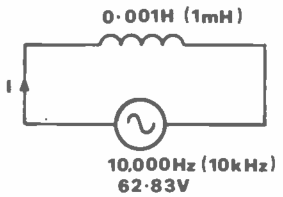
13. Referring to *Figure 6*, what is the total capacitance presented to the generator across terminals A & B?
(a) 20μF
(b) 15μF
(c) 10μF
(d) 5μF

14. In *Figure 6*, what is the capacitive reactance 'X_C' of the capacitor combination?
(a) 31.83Ω
(b) 318.3Ω
(c) 3183Ω
(d) 31.83KΩ

15. In *Figure 6*, what is the current 'I' flowing from the generator?
(a) 282.7mA/0.282A
(b) 28.7mA/0.028A
(c) 2.82mA/282A
(d) 0.283mA/28.3A

16. When an alternating current flows in a circuit consisting of pure capacitance:
(a) it lags the voltage by 90°
(b) it leads the voltage by 90°
(c) it is in phase with the voltage
(d) its frequency instantly halves

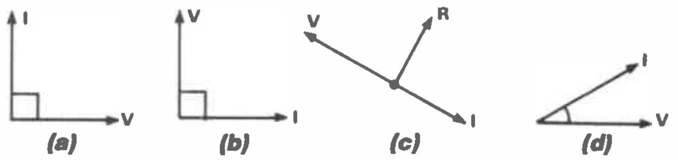
Fig 7



17. In *Figure 7*, what is the reactance of the inductor, and the current 'I' flowing from the supply?
(a) 6.283Ω/10A
(b) 62.83Ω/1A
(c) 628.3Ω/0.1A
(d) 1000Ω/6.28A

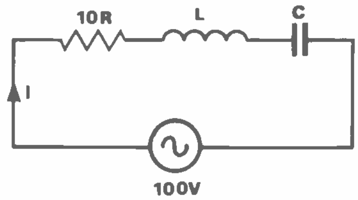
18. In a circuit consisting of pure inductance, the voltage:
(a) is in phase with the current
(b) lags the current by 90°
(c) leads the current by 180°
(d) leads the current by 90°

19. Which one of the phasor (vector) diagrams below represents your answer to Q18?



20. The series resonant circuit in *Figure 8* is said to be at resonance when:
(a) the values of inductance and capacitance are equal
(b) the supply voltage leads the current by 120°
(c) the inductive reactance 'X_L' is equal to the capacitive reactance 'X_C'
(d) the inductor has no copper losses

Fig 8



21. What is the resonant frequency of the series tuned circuit in *Figure 8*, given that L = 100mH (100 x 10^{-3}H) and C = 1000pF (1000 x 10^{-12}F)?
(a) 1.59KHz
(b) 15.915KHz
(c) 159.14KHz
(d) 20KHz

22. In *Figure 8*, what current will flow in the circuit at the resonant frequency?
(a) 10mA
(b) 100mA
(c) 1000mA
(d) 10A

23. Which one of the response curves shown below is typical of a parallel resonant circuit?

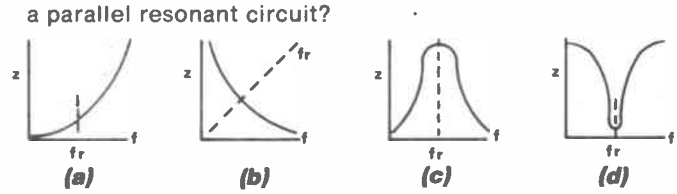
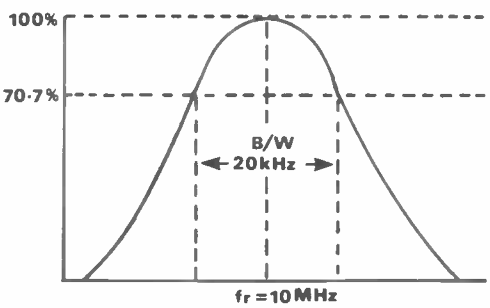


Fig 9



24. *Figure 9* shows the response curve of a parallel tuned circuit. What is the 'Q' of the circuit?
    (a) 10
    (b) 20
    (c) 500
    (d) 1000

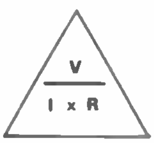
25. Reducing the value of the capacitor in a series or parallel tuned circuit will:
    (a) increase the resonant frequency
    (b) decrease the resonant frequency
    (c) have no effect on the resonant frequency
    (d) have no effect on the circuit 'Q'.

ANALYSIS

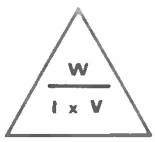
How did you get on with the questions? They were not really designed to catch you out, but rather to give you some practice in calculation and reasoning. I have attempted in the limited space available to make the questions as instructive as possible, which is why some of them are so closely related.

Let's take a look at each of the questions in turn.

Q1. Did you remember the Ohms Law triangle? It's all in there.



Ohms Law triangle



Power triangle

Q2. As for the power dissipated in R1, you can't get that from the Ohms Law triangle, can you? However, you'll be pleased to know that there is a 'power triangle' which works in exactly the same way (simply cover the unknown quantity and the required formula is exposed).

It is possible to combine the equations or formulae from the two triangles to produce other related equations, for instance:

$W = V \times I$

but $I = V/R$

which by substitution gives:

$W = V \times V/R = V^2/R$

also $V = I \times R$

which by substitution with $W = V \times I$ gives:

$W = I \times R \times I = I^2R$

We now have two new formulae for power.

Q3. First use the formula $I = V/R$, and substitute the known values ie: $I = 50/200 = 1/4 = 0.25A$.
To find the power,
$W = V \times I = 50 \times 0.25 = 12.5W$.

Q4. I bet you didn't like this one! In fact, it's the sort of everyday problem that a service engineer or amateur electronics enthusiast may encounter. Anyway, I hope you got it right or your next answer will almost certainly be wrong.

Q5. The jumble breaks down into four resistors in parallel. In December, Bill Mantovani gave you the general formula for parallel resistors, so write the formula down and just substitute the figures. Schoolboy maths really! Look:

$$\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \frac{1}{R4} = \frac{1}{R_T} = \frac{1}{20} + \frac{1}{20} + \frac{1}{20} + \frac{1}{20} = \frac{1}{R_T}$$

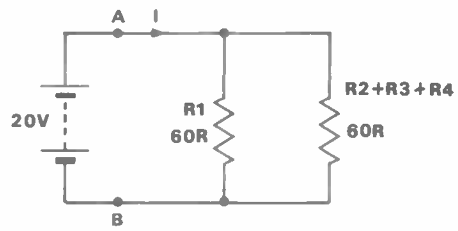
$$= \frac{4}{20} \text{ therefore } R_T = \frac{20}{4} = 5\Omega$$

Why not try this one on your calculator? Using the table, I'll work it out with you, step by step. I'm using a Casio fx-2800P, and if your calculator is different you may find that your 'displayed' result is not quite the same, but you'll soon get used to it.

COMMENTS	KEY STROKE	DISPLAY	EXP
Clear ↑	AC	0	
	20	20	
first resistor	INV	20	
1/20 ↓	1/x	0.05	
	+	0.05	
↑	20	20	
second resistor	INV	20	
1/20 ↓	1/x	0.05	
	+	0.1	
↑	20	20	
third resistor	INV	20	
1/20 ↓	1/x	0.05	
	+	0.15	
↑	20	20	
fourth resistor	INV	20	
↓	1/x	0.05	
$1/R_T$	=	0.2	
only necessary	INV	0.2	
where 1/x is a	1/x	5	Answer
2nd function			

Q6. To calculate the total resistance of this circuit, you must first calculate the resistance of the series branch R2, R3 and R4, which should be treated as a single resistor of equivalent value in parallel with R1. The total resistance of R2-R3-R4 = 20+20+20 = 60 ohms.

We can now re-draw the circuit (for the purpose of calculation) like this:



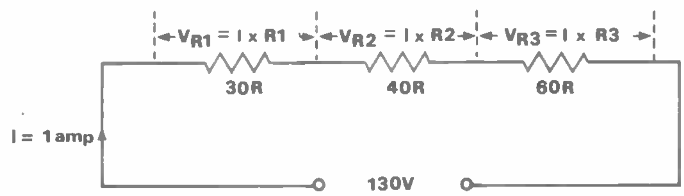
You can see that you now have a simple parallel circuit, which can either be calculated by the formula used in the previous question, or by means of the simplified formula:

$$R_T = \frac{R1 \times R2}{R1 + R2} = \frac{60 \times 60}{60 + 60} = \frac{3600}{120} = 30\Omega$$

Having found the total resistance of the circuit, the current flowing from the 20 volt supply is easy to calculate:

$$I = \frac{V}{R} = \frac{20}{30} = 0.66A$$

Q7. This question demonstrates the potential differences that exist in a series circuit. In this circuit, the sum of all the potential differences (PDs) add up to the supply voltage.



Calculate the total current:

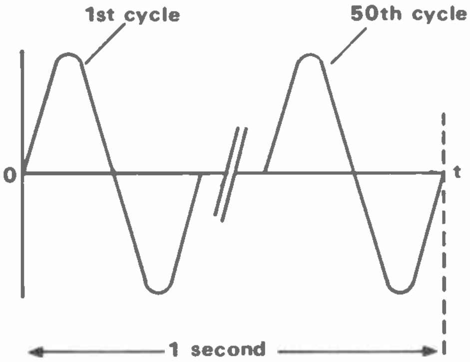
$$I = \frac{V}{R1 + R2 + R3} = \frac{130}{130} = 1A$$

The individual PDs are:

$V_{R1} = I \times R1 = 1 \times 30 = 30V$
$V_{R2} = I \times R2 = 1 \times 40 = 40V$
$V_{R3} = I \times R3 = 1 \times 60 = 60V$

The sum of the individual PDs is therefore:
30 + 40 + 60 = 130V.

Q8. Not much explanation required here – take our domestic ac mains supply, which has a frequency of 50 hertz. This means that there are fifty complete cycles of the voltage or current per second.



Q9. The peak value is always higher than the root mean square (rms) value. The formulae to remember are:

$$Vrms = Vpk \times \frac{1}{\sqrt{2}} = Vpk \times 0.707$$

$$Vpk = Vrms \times \sqrt{2} = Vrms \times 1.414$$

The peak-to-peak value is twice the peak value.

Q10. This is really just another Ohms Law calculation:

$$I_{rms} = \frac{V_{rms}}{R}$$

Q11. When the load is non-reactive, the current and voltage will be in phase.

A non-reactive load is one with negligible self-inductance and self-capacitance.

For most purposes a solid carbon resistor can be considered non-reactive. Wire-wound resistors usually possess some inductance and capacitance due to their construction.

Self-inductance and self-capacitance are not desirable features in a resistor, so resistor types must be carefully chosen to suit the proposed application.

Q13. This should have been fairly easy for you. The first step is to lump the two parallel capacitors C2 and C3 together, giving an equivalent capacitance of 10μF. Considering this as a single capacitor in series with C1, we find the total capacitance:

$$\frac{C1 \times C2{,}3}{C1 + C2{,}3} = \frac{10 \times 10}{10 + 10} = \frac{100}{20} = 5\mu F$$

Q14. The formula for capacitive reactance is:

$$Xc = \frac{1}{\omega C} = \frac{1}{2\pi fC}$$

where $\omega = 2\pi f$

Substituting all known values into the formula we get:

$$Xc = \frac{1}{2 \times \pi \times 1000 \times 5 \times 10^{-6}} = 31.83\Omega$$

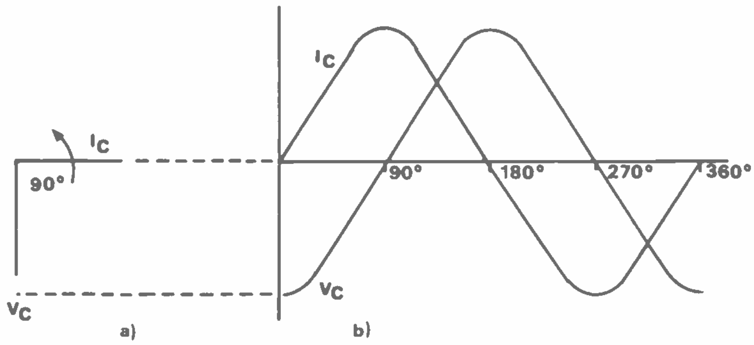
Practice with the calculator again – following the table – it will make life easier for you.

Q15. Substitute the known values into the formula:
$I = V/X_C$
Remember that there are 1000mA in one amp.

REMARKS	KEY PAD OPERATION	DISPLAY	← EXP →
clear	AC	0	
	2	2	
	X	2.00	
You are calculating	π	3.14	
the bottom line of	X	6.28	
the formula	1000	1000	
ie 2 x π x f x c	X	6283.19	
	5	5	
	EE or EXP	5	00
	6	5	06
change sign	+/−	5	−06
Inverse or second	=	0.03	
function if required	INV	0.03	
for 1/x Answer	1/x	31.83	

(see Q14)

Q16. In a circuit consisting of pure capacitance the current leads the voltage by 90°. This can be demonstrated by allowing the rotating phasor (vector) to trace the graph (as below, for a 360° revolution).



Q17. Another calculation – you should be getting used to them by now! Have you remembered the formula?

$$X_L = \omega L = 2\pi fL$$

That's it, but don't forget:

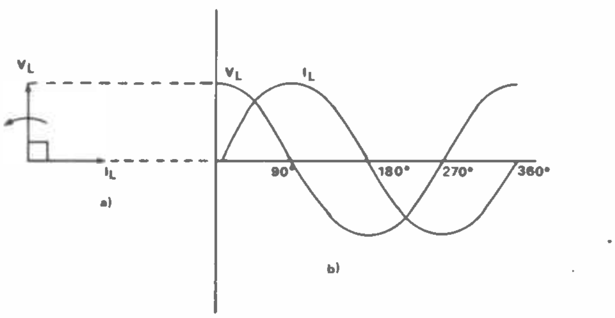
You shouldn't need the help of your calculator for this one, just substitute the known values:

$$X_L = 2 \times \pi \times 10{,}000 \times 0.001 = 2 \times 3.14 \times 10{,}000 \times 0.001 = 62.8\Omega$$

To calculate the current, substitute known values into:

$$I = \frac{V}{X_L}$$

Q18 & 19. In a circuit consisting of pure inductance the voltage leads the current by 90°. This is demonstrated below as for Q16.



Q20. The circuit is said to be at resonance when the capacitive reactance and the inductive reactance are equal ($X_L = X_C$). We can expand this to find the formula for the resonant frequency 'fr':

$$\omega L = \frac{1}{\omega C} \quad \text{or} \quad \omega^2 = \frac{1}{LC}$$

which means $(2\pi)^2 f^2 = \frac{1}{LC}$

which divided by $(2\pi)^2$ gives $f^2 = \frac{1}{(2\pi)^2 LC}$

which taking the square root of both sides gives

$$fr = \frac{1}{2\pi\sqrt{LC}}$$

This formula holds good for both series and parallel circuits.

Q21. Using what we have just learnt:

$$fr = \frac{1}{2\pi\sqrt{100 \times 10^{-3} \times 1000 \times 10^{-12}}}$$

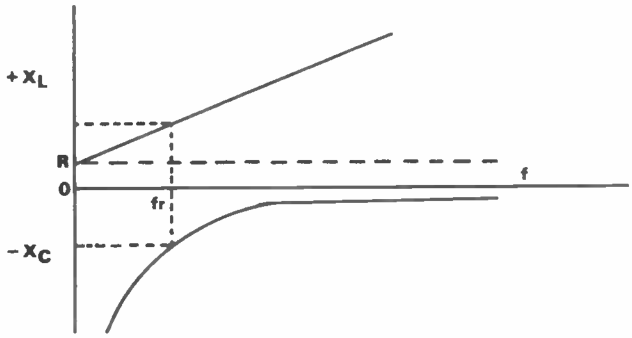
$$fr = \frac{1}{2\pi\sqrt{100 \times 1000 \times 10^{-15}}}$$

fr = 15.915KHz

Try it on the calculator, following the table.

REMARKS	KEY PAD OPERATION	DISPLAY	← EXP →
	AC	0	
	100	100	
L	EE or EXP	100	00
	3	100	03
	+/−	100	−03
	X	010	
√LC	1000	1000	
2π√LC; C	EE or EXP	1000	00
	12	1000	12
	+/−	1000	−12
$\frac{1}{2\pi\sqrt{LC}}$	=	1	−10
	√	1	−05
	X	1	−05
	2	2	
	X	2	−05
	π	3.14	
only necessary where 1/x is a 2nd function	=	6.28	−05
	INV	6.28	−05
Answer Hertz	1/x	15915.50	

Q22. Resonance occurs at the frequency at which the circuit reactance is zero, ie the inductive and capacitive reactances are equal in value but opposite in sign, as shown:



At resonance, the circuit is purely resistive and the current is calculated simply by using our old friend, Ohms Law.

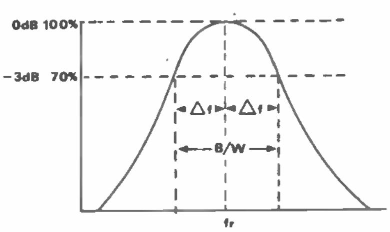
Q23. A parallel tuned circuit is sometimes referred to as a *rejector* or *tank* circuit, depending upon its application. When used to prêsent a high impedance to (or block) an unwanted signal, it is usually referred to as a rejector circuit. When used in the output circuit of an oscillator, buffer amplifier, frequency multiplier or transmitter, it is often called a tank circuit.

Q24. In this case 'Q' has been defined in terms of half-power bandwidth. The formula for this can sometimes vary, but don't let it confuse you: it means the same thing, ie:

Δf is the change in frequency required either side of the resonant frequency to reduce the power in the tuned circuit by half, or 3dB.

The response curve below shows that b/w = 2 f:

$$Q = \frac{fr}{b/w} \quad \text{or} \quad Q = \frac{fr}{2\Delta f}$$



The higher the Q-factor of the circuit, the sharper the response curve and the narrower the bandwidth at the half-power points.

Q25. Logically, reducing the value of L or C in a tuned circuit will increase the resonant frequency.

And now . . . tucked away at the back of the feature so you can't cheat . . .

ANSWERS

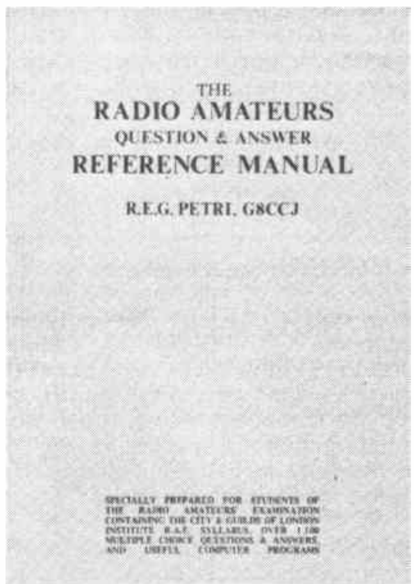
1 – a; 2 – a; 3 – b; 4 – c; 5 – c; 6 – d; 7 – a; 8 – c; 9 – b; 10 – a; 11 – c; 12 – c; 13 – d; 14 – a; 15 – a; 16 – b; 17 – b; 18 – d; 19 – b; 20 – c; 21 – b; 22 – d; 23 – c; 24 – c; 25 – a;

How many did you get right?

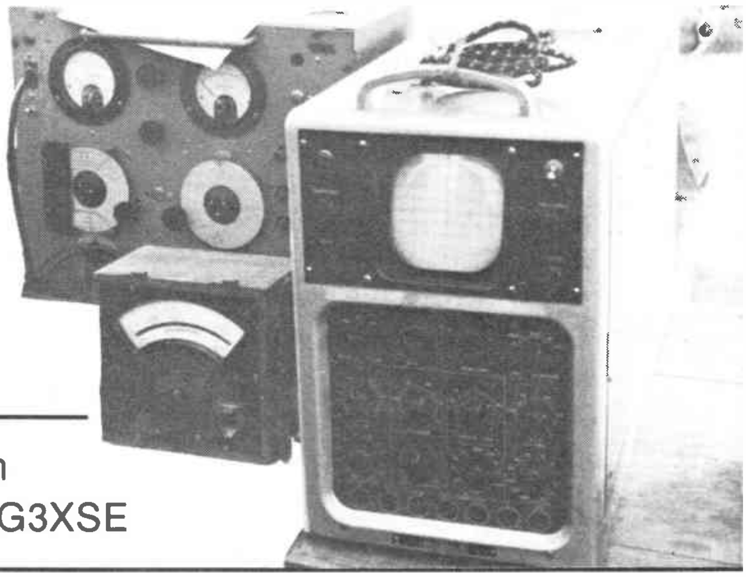
For more question and answer practice Ray Petri's book '*The Radio Amateurs' Q & A reference manual*' is available from:
W P Publications,
11 Wayville Road,
Dartford, Kent DA1 1RL.
Price £5.95 & £1.00 P&P

The book contains 20 sections of multiple choice questions and answers which follows the RAE syllabus in roughly the same order than any recognised RAE course would progress, making it an ideal source of course homework.

The book is also available from your local emporium.



SECONDHAND EQUIPMENT GUIDE



by Hugh Allison G3XSE

It wouldn't be fair to name names, it would be too embarrassing for the man in question. We will call him Paul, and I'll not mention that this Paul just happens to be the editor of *Short Wave Magazine*. Paul gets invited to give a lecture to a club in Chesham. The club in question offers to talk Paul in on GB3VA, the local repeater. On the night of the lecture our hero hears the club calling him at S9+ on his 2300, but they cannot hear him. Paul has to ask for directions from passers by.

Next morning Paul gives his 2300 to your scribe, requesting the PA be repaired. The 2300 is connected up to the workbench and produces a healthy two watts.

'Funny', says the editor of *SWM*, 'that's exactly how I had it last night'.

'Exactly how you had it?' enquires your scribe.

'Yes', says the editor of *SWM*.

Your scribe then explains to the editor of *SWM* that on a 2300, as with most rigs, you dial up the output frequency of the repeater in question on the rig and, by switching in the repeater shift, automatically transmit 600KHz down. Who had dialled up the *input* frequency (thereby hearing the club calling him on the input) and selected the repeat mode? As I was saying last month, even I cannot repair working equipment...

Switching

Continuing my analysis of repair by percentage of faults over the years, the second major category of faults after power supply related ones (detailed last month) are switching faults.

In my book, switching faults cover three distinct 'types' of switch, the normal on/off or rotary switch (including micro-switches), relays and electronic switching.

With normal switches, failure is often fairly obvious. Sometimes the switch just doesn't feel right, or doesn't sound normal when operated. Other faults can often be located by analysing what isn't working and following the fault back from there – the screen grid switch on Trio equipment detailed a few months back is a classic example of this. A problem with normal switches increasingly seen on my workbench is the failure of a switch that controls only a microscopic current.

A good example of this is a +5KHz switch on a synthesised rig, where the switch only has pico amps of CMOS gate current flowing through it. The failure mechanism is, apparently, a build-up of oxide on the switching surfaces. If the switch is handling larger currents the make/break spark is often enough to blast off the oxide layers, but with pico amps there just isn't the energy. Obviously the correct repair is to change the switch, but if one isn't available contact-cleaners such as 'Electrolube' can often work wonders.

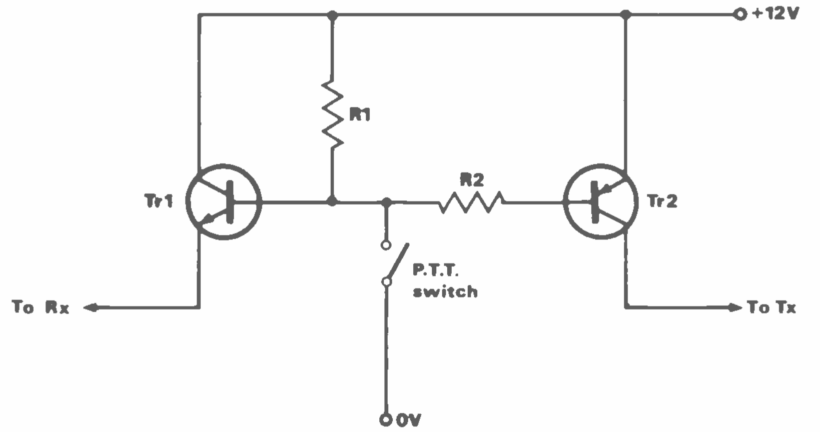


Fig 1 *Typical electronic switching circuit*

Suppose, however, that the switch is completely sealed. If it isn't possible to get the spray into the switching chamber, I have found a 'last ditch' bodge which works surprisingly well. *Disconnect the switch from the circuit* (it isn't necessary to remove it physically) and connect a current limitable power supply across the switching contacts. Set the current limit on the power supply to four fifth's of the switch's current rating, set the power supply voltage to, say, twelve volts, then keep operating the switch in question until you achieve a current flow. This method has been particularly successful with micro-switches. Several Sharp radio cassettes and dozens of Sony videos are proof that the method can give years of extended life.

Relays

Again, sound can be a clue. If, say, going from receive to transmit used to give a nice healthy 'clonk' and all you get now is a feeble 'tap', then the relay may well have a pair of welded-up contacts. Fortunately, most relays have transparent covers and it is often possible to watch the contacts move. Incidentally, most covers will come off on the clear plastic type. There are normally two small cut outs on the cover that are held in lugs. These are usually located at the wiring end of the relay, and the cover can be released by pushing the lugs back (or opening out the cover) with two jewellers' screwdrivers.

Welded up contacts can often be separated by putting a sharp blade *underneath* the contacts and pushing up (with due regard to personal safety). *Never* push down, you will bend the contacts apart in such a way that they will not make reliably in future. Old Pye

Cambridges are notorious for welding up their relay contacts for no good reason.

Electronic switching

Consider the circuit of *Figure 1*. The +12 volts is the normal, nominal rig voltage after the on/off switch. With the push-to-talk (PTT) switch open, R1 keeps Tr1 biased on and thus the supply is routed to the receiver. If the PTT switch closes, the base of Tr1 is taken to ground and it ceases to conduct. Tr2, being a PNP transistor, now conducts since R2 biases it on. Simple enough? The above circuit is extremely common (with minor variations) in most hand-portables and, dare I say it, in CB rigs. Normally the PA transistors and the audio output stages are connected to the 12V rail at all times and only the lower power stages are switched, thus allowing low current transistors to be used.

A common fault is that the owner runs the rig into a short circuit. This blows the PA transistor (which, as above, is not connected to the switching circuit). The now duff PA stage causes the driver stage to take excess current, due to it running into a different load from normal. The driver stage is switched by the above circuit, and the excess current blows up Tr2. Often this is fairly spectacular, and blows a hole in the transistor case or cracks it in half.

The Palm range of hand-portables (Palm II and Palm IV) are particularly prone to the above. The quick way of verifying that the above has happened is to look for volts on the collector of the driver transistor whilst holding down the transmit switch. No volts coming up equals a dead switching transistor.

Next month

Next month I'll be looking at common problems with the Dressler D200S 2m linear amplifier and integrated circuit audio amplifiers.

Amateur RADIO SMALL ADS

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The RADSOFT complete Receive System which includes ready made boxed miniature terminal unit & machine language program. Plug in and receive RTTY @ 45, 50, 56 & 75 BAUDS MORSE from 5-70 WPM. This well proven system ONLY £40.

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CAMBRIDGE KITS
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Amateur RADIO SMALL ADS

This method of advertising is available in multiples of a single column centimetres — (minimum 2cms). Copy can be changed every month.

RATES
per single column centimetre:
1 insertion £7.00, 3 — £6.60, 6 — £6.30, 12 — £5.60.

AMATEUR RADIO SMALL AD ORDER FORM

TO: **Amateur Radio · Sovereign House**
Brentwood · Essex CM14 4SE · England · (0277) 219876

PLEASE RESERVE..............centimetres by..............columns

FOR A PERIOD OF 1 issue........☐ 3 issues........☐ 6 issues........☐ 12 issues........☐

COPY enclosed........☐ to follow........☐

PAYMENT ENCLOSED:........ £ —

Cheques should be made payable to Amateur Radio. Overseas payments by International Money Order

CHARGE TO MY ACCOUNT........☐

COMPANY ....

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SIGNATURE ....TELEPHONE..............................

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ADVERTISERS INDEX

Amateur RADIO

ADVERTISING RATES & INFORMATION

ABC membership approved pending first audit Jan-Dec 1985

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
			series rates for consecutive insertions		
61 x 90	⅛ page	£66.00	£62.00	£59.00	£53.00
128 x 90 or 61 x 186	¼ page	£115.00	£110.00	£105.00	£92.00
128 x 186 or 263 x 90	½ page	£225.00	£210.00	£200.00	£180.00
263 x 186	1 page	£430.00	£405.00	£385.00	£345.10
263 x 394	double page	£830.00	£780.00	£740.00	£660.00

COLOUR AD RATES

depth mm x width mm	ad space	1 issue	3 issues	8 issues	12 issues
		colour rates exclude cost of separations	series rates for consecutive insertions		
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£550.00	£530.00	£470.00
263 x 394	double page	£1,130.00	£1,070.00	£1,010.00	£900.00

SPECIAL POSITIONS

Covers	Outside back cover 20% extra, inside covers 10% extra
Bleed	10% extra [Bleed area = 307 x 220]
Facing Matter	15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proofs & small ad	mono artwork	on sale thurs
Mar 85	31 Jan 85	6 Feb 85	8 Feb 85	28 Feb 85
April 85	28 Feb 85	5 Mar 85	8 Mar 85	28 Mar 85
May 85	28 Mar 85	3 Apr 85	4 Apr 85*	25 Apr 85
Jun 85	25 Apr 85	1 May 85	3 May 85	23 May 85

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.

An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.

Previous copy will automatically be repeated if no further copy is received.

A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.

Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

COPY
Except for County Guides copy may be changed monthly.

No additional charges for typesetting or illustrations (except for colour separations).

For illustrations just send photograph or artwork.

Colour Ad rates do not include the cost of separations.

Printed — web-offset

PAYMENT
All single insertion ads are accepted on a pre-payment basis only, unless an account is held.
Accounts will be opened for series rate advertisers subject to satisfactory credit references.
Accounts are strictly net and must be settled by the publication date.
Overseas payments by International Money Order or credit card.

FOR FURTHER INFORMATION CONTACT
Amateur Radio, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219876

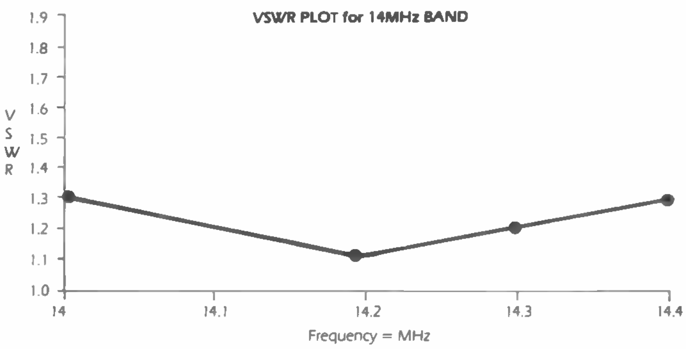
Commission to approved advertising agencies is 10%.

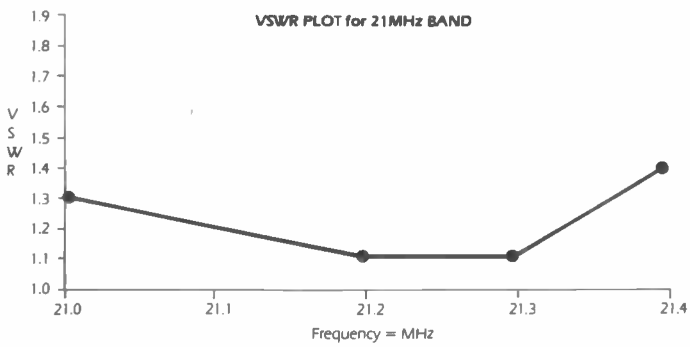
CONDITIONS
10% discount if advertising in both Amateur Radio and Radio & Electronics World.
A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

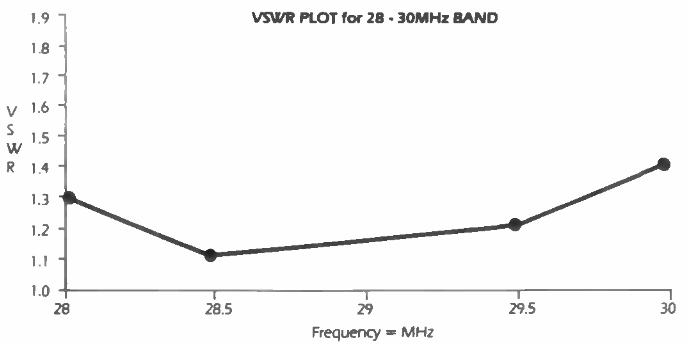
A New Approach to HF Antennae Design

Compare these performance figures of Hightech Antennae's **MBFr80** with the best 3 element antennae available today.

	Typical Spec. for 3 element Tri Band Beam	**Hightech Antennae's Spec for MBFr80**
	No. of Elements — 3	2 Parasitic + 1 Absorber Element
Front to Back Ratio	25dBd	43dBd
Forward gain	6dBd min.	Better than 4.5dBd
VSWR at Resonance	1.5 : 1	1.1 : 1
Max. Power Input	1kW (100% duty cycle)	2kW (100% duty cycle) 5kW peak
Input Impedance	50 ohm	50 ohm
Boom Length	4.2m	4m
Max. Element Length	8.2m	4.6m
Max. Wind Survival	75mph	100mph
Net Weight	16.3kg	8kg
Wind Load	80mph = 47kg	100mph = 23kg







The front to back ratio advantage from Hightech Antennae's **MBFr80** is 18dBd better than other antennae available today. Remember this is a 3 S-unit noise reduction in unwanted directions over and above other antennae.

6dBd = 1 S-unit

Massive front to back ratio. This is more important than forward gain on today's crowded amateur bands.

Flat VSWR across all HF bands.

No need for the purchase of ATU's for those with solid state PA's.

No need for the purchase of baluns.

A complete break with the coil and capacitator trap arrangement with, of course, its associated losses, restricted bandwidth etc.

Expandability: Extra parasitic element (director)
Extra absorber element for even greater front to back ratio.

With the conversion kits available, a 3 element, 3 band beam with an enormous front to back ratio will become the standard for others to follow.

HIGHTECH
Antennae (Scotland) Ltd

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NEW RELEASE

FEATURES

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- ★ GaAsFET RF stage
- ★ Transmit ALC circuit
- ★ 13.8V DC operated
- ★ Repeater shift (normal, simplex, reverse)
- ★ High level DBM mixer
- ★ LED Bargraph Power Meter
- ★ RF Vox – Adjustable delay & manual override

SPECIFICATION

General

Input freq range	: 28-30MHz
Output freq range	: 144-146MHz
Repeater shift	: Simplex, normal, reverse
DC requirements	: 13.8V DC & 6 Amps

Transmit Section

Output power	: 25 watts +/- 1dB
Input level range	: ¼ to 300mW
ALC range	: 20dB
Modes of operation	: SSB, FM, CW, AM
Spuribus outputs	: -65dB or better

Receive Section

Gain	: 20dB min
N.F.	: 2dB or better
3rd order intercept	: +19dBm (output)

DESCRIPTION

This new transverter has been designed to allow users of existing HF band transceivers to establish a first-class transceive facility on the 144MHz band.
The MMT144/28-R incorporates many new and exciting features which combine to make this product simply superb.

Receive Section
An NEC GaAsFET is employed in a noise-matched configuration feeding a high level double balanced mixer via a bandpass filter. IF gain is achieved by a JFET post amplifier. This combination produces a good signal to noise ratio, excellent immunity to overload and cross modulation, resulting in a rugged receive system having a third order output intercept point of +19dBm.
Two separate low-noise oscillators, operating at 116.00 and 115.40MHz are included, running from a regulated 8.2 volt supply. Selection of the wanted oscillator is achieved by a quad op-amp circuit, controlled by the front panel mounted 'MODE' switch. This provides simplex, repeater and reverse repeater operation. The output of each oscillator feeds a JFET buffer amplifier via the quartz crystal which acts as a filtering element to reduce amplitude noise and reciprocal mixing products. The resultant high level injection is extremely pure and free from harmonics.

Transmit Section
The incoming 28MHz signal, in the range ¼ to 300mW, is initially fed to the RF VOX circuit, ALC control circuit and the input level control. This signal is then fed into a pair of MOSFETs in a balanced mixer configuration, together with the local oscillator injection, to produce the wanted signal in the range 144-146MHz.
This signal is then amplified by several linear stages up to the specified output power of 25 watts. A visual indication of relative output power is provided by a front panel mounted LED bargraph display.
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PRICE : £215 inc VAT (p+p £3.50)

Access VISA

HOURS:
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9-12.30. 1-5.00
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