Microwave Newsletter

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Microwave Newsletter (May) 04/82

Many thanks to those readers who have sent in news and other information. Any items for the next issue should be sent to J. N. Gannaway, G3YGF at Dean Hill Barn, Dean Hill, Salisbury, Wilts. SP5 1HJ. Please note the new address for Julian, whose telephone number is Romsey (0794) 40008. The next newsletter is due out shortly before the cumulative in June (20th June) and items should be sent to arrive by the 7th June.

A total of 26 new subscribers to the newsletter were gained at the Alexandra Palace exhibition and the distribution list is now above 100. Many thanks to everyone renewing their subscription also. We would like to apologise to anyone who had sent in £3 before we announced it would be necessary to increase this to £4, and also for the omission of the SAE with the renewal reminder. The editors hope that distribution is now properly sorted out.

News

A reminder that the next Winchester Round Table will be held on Sunday 13th June starting around 10.30 am. The location is IBA Crawley Court, Nr Winchester, Hants, and further details of how to get there are available from G3JHM, QTHR, telephone 0420-63315. Unfortunately we do not have any details of the program, but no doubt there will be some test equipment and a signal for anyone trying to align 10GHz narrowband equipment.
Also that weekend, on the 12th June, will be the next Sheffield Round Table starting just after lunch. The meeting will be in the St George's building, Mappin Street, which is part of the University. Further details from G8AGN who is QTHR.

The latest issue of VHF Communications, 1/82 contains a number of interesting items including:

A Gunn Oscillator for the 24GHz Band by DC3QS	pp35-37
A Noise Generator for VHF and UHF by DB2GM	pp38-43
Some Pitfalls in Noise Figure Measurements by G3YGF and G4FZZ	pp44-48

The 24GHz Gunn design uses reduced height waveguide to improve stability. The authors version has been milled out of aluminium but standard WG20 can also be used with a wedge soldered into place. A taper is used to bring the height back to normal WG20.

A few people visiting the microwave committee stand at the Alexandra Palace exhibition filled in their names on a list of active microwave stations. A few of these are probably new to most readers:

G4AMZ	Lytham,Lancs	5.7GHz
ON6JY	Soignies	5.7, 10GHz
G4EML	Guildford	10GHz
G8XCY	Godalming	10GHz
G4MDN	Chalfont	10GHz soon
G8POA	Reading	10GHz soon

We understand that PA2DOL has a number of commercial varactor mounts for sale for 10GHz. These are similar to a design which has appeared in VHF Comms and the cost is believed to be around £13 (plus p&p). Anyone interested could contact PA2DOL who is Dolf van Delft, address: de Damhouderstraat 94, 3052 NK Rotterdam, The Netherlands.

Several people have asked about the SRD type for a 5.7GHz "JVL" transverter. The type used on 10GHz can be used, and G3YGF is able to supply these.

Peter, G3PHO has sent a copy of the Microwave Site Data Sheet which he fills in at each site he uses. Firstly the site details are written down: name, lat and long, ngr, qth locator, height asl and any access details. Then all paths tried are logged with the following headings: Other site, its NGR, its QRA locator, grid bearing to the site, path length, whether optical, date first worked, station worked, frequency, mode and power. Obviously the headings can be varied, but the essential thing is to record all attempts, including those that fail. Peter says this is then most useful when he is next on the site as beam headings are ready worked out and there is some indication as to whether the path will work or not. He suggests that copies of these type of log sheets could be sent to G3JHM for use in preparing a map of paths worked. If anyone requires a copy of a suitable sheet G4KNZ will be happy to send a copy on receipt of an SAE.

Peter also says both G8AGN and himself have been trying out the G3WJG filter from Wireless World sept 1978. The bandwidth is considerably wider than the JVL type but is easier to tune up, and has a loss of about 0.5dB. G4APV has built a narrowband rig using these type of filters and anyone having difficulties aligning a JVL transverter might like to get going on NB in the same way. Peter also comments on how long it takes to complete a WB qso when different rx IF's are used and a Gunn diode has to be retuned at the end of each over. He wonders if more attempt can be made to standardise on a standard IF when full duplex can often be used. Unfortunately there are differences in opinion as to which standard is best - G4KNZ and G3YGF are using 10.7MHz, for instance, which is easy to build as no frequency conversion is needed in the IF strip, while G3PHO is using both 30 and 100MHz. Do readers have any comments on the subject?

G3WDG and G4KGC report hearing their first signal on 2320MHz via the moon. This was DF0EME who was running 500W to a 30 foot dish using linear polarisation. The receiving equipment was a 13 foot dish using circular polarisation with a 2dB NF preamp and signals were "0" copy. Charlie reports working 11 stations in the ARRL EME contest at the beginning of May on 23cm.

The Net in the Sheffield area is still very active each Monday at 8 to 9pm local time on 144.330MHz. Participants include G8AGN, G3PHO, G4APV, G8GUH, G3ZIV and G4FXW.

Bill Hawthorne, G3MCS is located at Lacey Green on the Chilterns with a very good fixed QTH. If anyone is interested he is prepared to provide a site for a 10GHz beacon (or some other microwave band beacon). Bill can be contacted on 084-44-4343 and is QTHR.

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G4FRE reports hearing PA0[illegible] at 10dBN and ON4RUG at 4dBN on 10GHz narrowband when located at AL07b on the 4th March, using a 45cm dish. Dave also heard the Alderney beacon from Beachy Head via a duct. He is building for 9cm and says he now has a receiver working.

G4ASR is operational on 5.7GHz with 12W to a 1 metre dish. Tests with G3FYY and G4NBS so far have been unsuccesful but these were over rather long paths. Anyone in the Midlands on 5.7GHz may be interested in tests.

G4APV and G3PHO are conducting fixed station tests over an 8km path. Both stations are planning to mount WB tranceivers on the roof to set up a more permanent link. Any other stations in the area (Sheffield) may be interested in joining in.

Adrian, G8PGF sends a detailed report on his 23cm equipment. On receive he uses a MGF4535 plus an MGF901 into a filter followed by a second MGF901 and a mixer and then an IC202 for the IF. The antenna is a 15/15 yagi fed with heliax (loss about 1.7dB). The tx side is still under construction and is based on the VHF comms design in 1/78 and 2/78 with a PA based on the 1/79 design. Adrian is located at Enfield and he says he hopes to be fully operational by the end of the summer. It is nice to see there is still an interest in home construction on the band after the arrival of commercial transverters!

Clive, G4MBS reports the electricity board have moved the power line which was running across his back garden. He can now use a wider angle for the guys to the fly-swatter and remain on the air in windier weather. On 2.3GHz Clive says he can now operate on both 2304 and 2320MHz to cope with those stations who have moved up the band. Also another satellite signal has appeared on the band, about 5pm in the evening, which does not appear to be related to the two others making a total of three signals which can be heard during the course of the day. The contest last weekend (1/2 May) did not provide any contacts on 2.3GHz and Clive criticises the practice of these being arranged on 1.3GHz since there are one or two operators including himself who are on 2.3GHz only.

GB3SWH at Bushey Heath is now on the air on a frequency of 10368.240MHz. Don, G3JHM heard it at about 1dBN just before the first cumulative from a site near home. He has since heard it about 20dBN from Hindhead, but not from the site near home since. Clive, G4MBS has listened from home, but nothing has been heard so far. Steve, G4KNZ has heard it from Windsor Great Park, about 15dBN, but trees on the horizon were in the way of the path and it should be much stronger from this area. Also, Julian, G3YGF has copied the beacon whilst mobile, when driving from Ickenham to Pinner in North London. This included being parked in the drive at Pinner. He comments that this is the first narrowband beacon on which is beaming at the UK (and not the continent)! Any more reports of reception would be welcome, and it should be possible to hear the beacon from the Chilterns and North Downs without any difficulty.

The 10GHz beacon on Emley Moor is proving of immense value to several stations in the North. These include G4APV who aligned his gear receiving it from his bedroom window, G8GUH who also can copy it from home (on open guide), and G8AGN and G3PHO who have to make a short journey of a mile or so to receive it. We understand it has been received from a site near Hathersage in the Peak National Park, and wonder if anyone in the Midlands has heard it yet?

G3AYJ reports that the beacon he is building on 10GHz, GB3CEM is progressing and he hopes it will be on in the near future.

We have had one or two comments requesting more info on microwave beacons. In particular more technical information than is contained in the RSGB printout, and a more exact location. Thus if any beacon keepers send in this information (see GB3NEW last month) we will be pleased to include it. A complete list of the 23cm beacons is to be found later in the newsletter, and we hope to do the same for other bands in due course. In paricular we can include an NGR for the higher bands which might be useful for aligning a dish.

G8EUQ reports that GB3LDN on 2.3GHz is quite strong at Luton and can be heard even on a dipole in the shack!

Microwave Committee Meeting 09/May/82

At the meeting of 9th May the following topics were discussed: It was agreed that a video recording introducing basic and more advanced systems on 1.3 and 10GHz should be made for club use. Locator systems were discussed but it was felt that for the present a mixed system using NGR, Lat/Long and QRA would prevail.
The topic of the two metre calling channel for 10GHz was discussed at some length and the possibility of changing the frequency was considered. Feedback from readers would be of interest to the committee.
Beacons and Repeaters were discussed and it was noted that GB3SWH is now operational. Also, it is hoped that more of the 1.3GHz repeaters will soon be on the air. Post type filters and mixers for 10GHz were discussed under technical items.
The VHF Convention and Alenandra Palace exhibition were reviewed. The forthcoming round tables were previewed (at Winchester and Sheffield).
Compatability between TV operation and the new licence and band plan on 1.3GHz were discussed. Five proposals for TV repeaters were now complete and were expected to be forwarded to the Home Office in the near future.

Graham Murchie G4FSG, Chairman

Apologies if the above report is a little brief - it has just been written after the meeting prior to leaving the manuscript at RSGB HQ!

The five TV repeaters due to go to the Home Office in the near future are:

GB3GV	5km W of Leicester	ZM25f
GB3TV	2km N of Luton	ZL08d
GB3UD	12km NNW of Stoke on Trent	ZN79b
GB3UT	3km E of Bath	YL49e
GB3VR	3km NW of Worthing	ZK18b

Microwave directory entry:
Simon Pike G8[illegible]PD, Romsey, Hants.
Telephone: 0794-515222 ex 374 (daytime)
Equipment: 10GHz WB

Any more entries for the directory are very welcome.

One or two odd bits of information have been held over, apologies to contributors for this. Apart from info on beacons, one or two other items are in hand which we hope will appear eventually. In particular information on 10GHz omni antennas for beacons. Apart from anyone he has already contacted on this subject, G4KNZ would be most interested to hear from anyone who has built such an antenna.

73 de G3YGF, G4CNV and G4KNZ.

Reports from the 1st Cumulative

G3PFR reports being active from Meriton Low and that there was a very high level of activity in the North and Midlands. Mike worked G8MWR near Oakham (91km), G3PHO at Macclesfield Forrest (14km), G8HMV and G3YJH on Titterstone Clee (97km), G3ZME on Brown Clee (87km), G8GUH at Albort Height (28km), GW3PPF at Llandrindod Wells (128km), G8AFC on Winter Hill (65km) and G3KPT at Bromsgrove (82km) all two way. Also worked cross band were G4APV at Macclesfield Forrest, G6BFV and G8VZT on Brown Clee. Mike says he was particularly pleased to work up to Winter Hill which is an obstructed path he has tried many times before and failed.
Also on site were G8AGN, G8PNL, G3PHO and G4APV at various times during the day. One snag was thus the multitude of carriers on 10GHz and also much cross-mod and blocking of 2m receivers! Mike concludes by saying he hopes this level of activity continues over the season.

G3YJH was located on Titterstone Clee also working a large number of stations - 13. These were G3AYJ on Barr Beacon, G4FUQ also on Barr Beacon, G3ZME on Brown Clee, G3KPT on the Clent Hills, G8ASW also on the Clent Hills, G3FYX on Cleeve Hill, GW4KNZ on Mynydd Maen, G3MWQ on The Wreakin, G8AGN at Meriton Low, G3PFR also at Meriton Low, G8HMV nearby on another part of Titterstone Clee and GW3PPF at Llandrindod Wells. Dave reports trying with G8BUQ and G4MBS but failing and he missed G8AFC and G8GUH. The Clee Hills were also a popular site with a total of 7 stations on the two Hills. Dave says he now has 2W of narrowband which he will be using in the next cumulative.

G3FYX was on Cleeve Hill with 10 and 2.3GHz in the last cumulative. On 10GHz Roy worked GW4KNZ, G3YJH, GW3PPF, G3MWQ, G8HMV, G3ZME all two way, and G4MBS and G3YGF cross band (locations as in other reports). On 2.3GHz G4MBS was worked at Upper Wield, and G4LRT at 15km E of Rugby, and an incomplete contact was had with G8ADC.

G3PHO started the day from a new site 5km ESE of Macclesfield (1550 ft asl). G8AFC was worked on Winter Hill (51km), then G8AGN and G3PFR on Meriton Low (14km). Trees were blocking the path to the West Midlands and so Peter (and G4APV also on site) moved to Meriton Low. The following stations were then worked: G3ZME, G6[illegible]FV and G8VZT all on Brown Clee (90km), GW3PPF at Llandrindod Wells (130km), G8HMV and G3YJH on Titterstone Clee (98km), G3MWQ on The Wreakin (69km), G8GUH at Alport Hill (28km) and finally G3KPT at Walton Hill. All the contacts were made using WB equipment. Peter reports that Bob, G4APV worked most of these stations also using a "through line mixer" to a PW type dish.
G8GUH was active from Alport Hill near Matlock. The site was 1032 ft asl and looks very promising since 10 stations were worked: G4FUQ on Barr Beacon, G8HMV, G8VZT, and G6BFV on the Clees, G3KPT and G8ASW on Walton Hill, G3MWQ on The Wreakin and G3PFR, G3PHO and G8AGN on Meriton Low. Best DX was G8HMV at 105km.

G8AFC was operating from Winter Hill working 10 stations all using wideband equipment. The paths were all of the 100 to 130km length (see other reports). However, he did take out narrowband gear with a 4ft dish but found nobody to try with. Paul is hoping several stations with narrowband will be located on suitable site to try towards Winter Hill in the next event. Particularly of interest would be paths which are not quite optical - single diffractions etc.

G8KRD has recently completed 10GHz equipment and operated from Farley Mount, 8km W of Winchester. Simon worked G3IW at St Catherines Point and G3YGF on Dean Hill, and also G3IZD at Win Green was worked cross band.

G4MBS was operating from home as usual with high power on both 2.3 and 10GHz. On 10GHz G3YGF was worked both ways, G3FYX copied Clive's signals easily, but signals were only just detected the other way resulting in a cross band contact. Attempts with G3JHM on the Purbecks, G8MCQ near Wareham, GW4KNZ on Mynydd Maen, and G3YJH on Titterstone Clee all failed, while G8SHF and G3IZD just detected Clive's signals from Win Green, but not strong enough to complete a cross band contact. On 2.3 GHz G3FYX was worked on Cleeve Hill. Attempts with G8ADC and G4LRT both failed. Activity in the South was not all that high and Clive is hoping for more contacts in the next leg.

G8EUQ (Luton) was on 2.3GHz during the last cumulative and heard G4LRT at Rugby. Also, G4MBS was heard several times at about noise level, each time for a period of about 20 seconds.

G3JHM was located at the Purbeck's working G3IW at St Catherine's Point, plus G8SHF, G3IZD and G3VFU all at Win Green. Don comments on the low level of activity around the South coast, and hopes to do better this month.

G3YGF was operating from Dean Hill near Romsey and worked the following: G4MBS at 38km, G8KRD at 13km, G8MCQ and G8OWZ at 56km, G3IW also at 56km, all 2 way. Also GW4KNZ at 125km and G3FYX at 102km were worked cross band.

G8SHF and G3IZD were located at Win Green working the following stations: G3JHM at the Purbecks, GW4KNZ on Mynydd Maen, G3KEU at Bull Barrow, G3IW at St Catherines Point, G8MCQ and G8OWZ 8km S of Wareham. G3IZD also heard G8KRD near Winchester. Attempts with G4MBS and G3MTG were unsuccessful.

G4FRE operated from a site in AM78f for the cumulative working G3LQR for the first time (23km) on 10GHz. Also PA2DOL who was running 10W was heard at 40dBN over a 210km path. On 2320MHz PA2DOL was worked, as was G3LQR and also PA0FRE and PA0WWM over 210 and 205km paths respectively. A cross band contact was had with PE0QHN on 2.3GHz, being heard by G4FRE at 519. Dave's gear on 2.3GHz is 2W and a NE645 preamp to a loop yagi. He comments that he has scored something like 100 times the points recorded by last year's winner on this band.

GW4KNZ was located on Mynydd Maen and worked the following stations: G8SHF and G3IZD on Win Green (102km), G3FYX on Cleeve Hill (78km), G3YGF on Dean Hill (124km), G3YJH, G3AYJ and G8FWA on Titterstone Clee (85km), all contacts 2 way except with G3YGF. An attempt with G4MBS failed, although Clive is normally heard without any difficulty from this site. Also G8HMV on Titterstone Clee was not worked, despite 3 other contacts to this site, and this was put down to the path being very marginal.

2nd Cumulative Activity List

Callsign	Telephone, Location	Equipment
G3AYJ	021-354-5783, Titterstone Clee, SO595755, Salop.	WB
G3FYX	0454-778288, Cleeve Hill, SO997246, Gloucs.	WB, NB & 5.7GHz
G3IZD	via G8SHF, possibly Win Green, ST925205, Wilts.	WB & NB
G3JHM	0420-63315, Rutser Hill, SU717204, Hants.	WB & NB
G3PFR	0928-88427, probably Meriton Low, SK028595 or Winter Hill, SD661146.	WB
G3PHO	0742-681216, probably Meriton Low, SK028595 or Alport Hill, SK306516.	WB
G3WDG	0327-52100, possibly Walbury Hill, SU374616, Hants.	WB & NB
G3YGF	0794-40008, Dean Hill, SU276260, Hants.	WB & NB
G3YJH	05433-4280, Titterstone Clee, SO595755, Salop.	WB & NB
G3ZME	0952-55416, Brown Clee, SO594867, Salop.	WB
G4KGC	0327-52100, possibly Walbury Hill, SU374616, Hants.	NB & 5.7GHz
G4KNZ	0344-23200, possibly Mynydd Maen, ST260977 or around this area.	WB & NB
G4MBS	0420-62316, Upper Wield, SU634388, Hants.	NB & 5.7GHz
G8AFC	061-865-3183, Winter Hill, SD661146, Lancs.	WB & NB
G8AGN	0742-304888, Meriton Low, SK028595 or Axe Edge, SK030700.	WB
G8CZE	061-370-5825, Winter Hill, SD661146, Lancs.	WB
G8GKV	0903-206384, Chanctonbury Ring, TQ134120, W Sussex.	WB
G8SHF	0272-855693, possibly Win Green, ST925205, Wilts.	WB & NB
F1BQ, F3LP & F1CVU	Octoville, AJ31e.	WB
F8WN	Mnt Casigny, AJ51h.	WB

This list is only as long as readers make it! There were very few entries last month, because very few operators sent in an entry. This month is a little better but we know of a number of people who are very likely to be out but are not included! If you support the inclusion of this list please send (or phone) your entry to us. We hope the telephone numbers are correct but please inform us of any errors.

04/04/82

A Directional Coupler

This design is an attempt to produce a coaxial directional coupler for use from HF to the low microwave bands. It's main feature is a fairly high directivity without relying too much on high precision construction.

The directivity obtained depends on the accuracy of the Zo of both the main and coupled lines, as well as the load terminating the coupled line. The directivity is obtained by sampling a small fraction of the E and H fields in the main line using a small slot which is less than a quarter wave long. These fields leak out into the coupled line and reproduce the forward and reflected waves in the coupled line. The accuracy of the sampling is improved in this design by using equal diameter lines with the same dielectric.

Consider Fig 1, where the coupler has a load with a 1.2:1 swr (20dB return loss) on it. The forward power will couple -30dB into the termination, and the reflected power -50dB into the detector. If the coupled line termination has an swr of 1.2:1, then this will also reflect -20dB of the incident signal (-30dB), ie -50dB back to the detector. This is then producing a signal at the same level as the one to be measured.

One of the main problems in obtaining a high directivity is that of making the lines, either coax or stripline sufficiently accurately, and also doing the transitions from them to the loads and connectors. For this reason, any couplers built using homebuilt lines are unlikely to be very directive unless they are checked or adjusted on known testgear.

Construction

Semi rigid coax of any diameter can be used, 0.141, 0.250 and 0.325" being common values. They can be used with bnc, sma or N type connectors according to the size, but ensure that the connector is intended for use with that size of cable, or there may be a significant swr introduced. The larger sizes are stronger mechanically, and easier to work with, and can be made to fit into N connectors quite easily.

Hold the cable in a vice and file away the outer to form a flat on the cable of the desired length. It should be a quarter wavelength long in the cable dielectric (ptfe) at the highest frequency required. (e_r is 2.1) Fig 2.

Be careful not to tear the copper outer away from the ptfe by over enthusiastic filing. At each end of the slot taper the thickness of the copper so that the gap between the two cables is as small as possible. Bend the second line to the shape shown before filing the slot in it. Then clamp the two together and solder them, all the way round the join to seal the coaxes again. The slot width should be about 1mm on the 0.141, and 2mm on the larger sizes.

The high directivity is only obtained for fairly weak coupling, and the slot widths shown give about 35dB maximum at the high frequency end of their range. 30 dB should be regarded as the maximum value to be used, as the slots then become too wide and begin to alter the Z_o of the line.

The coupling coefficient and directivity vary with frequency as shown in Fig 3 for a typical example. A directivity of 20-25dB is typical, and the coupling varies at the rate of 20dB per decade of frequency.

Connectors will be required at the ends of the main line, but on the coupled line there are two options: either use connectors, which is the most flexable option as then its performance can be measured easily on test equipment. Alternatively, the load and detector can be soldered directly onto the cable. A 50 ohm chip resistor soldered across from inner to outer will provide a good enough load. The diode detector can then be soldered across another 50 ohm chip resistor at the other end of the line.

The type of detector must be chosen according to the power level and coupling coefficient used, as shown in Fig 4. A receiver or amplifier is needed at very low power levels, the diode short circuit current meter previously described in the newsletter is useful in the range -40 - 0dBm, and an open circuit voltage detector (described in the newsletter and the Microwave committee 384MHz oscillator article in Radcom) is suitable for powers above 0 - 10dBm. Above about 20dBm the dissipation in the chip resistor becomes excessive. Here, external attenuators could be used. The coupler would normally be used as shown, but provided that the swr of the resistor and detector are good enough, they can be mounted at both ends of the coupled line so that power in both directions can be monitored simultaneously

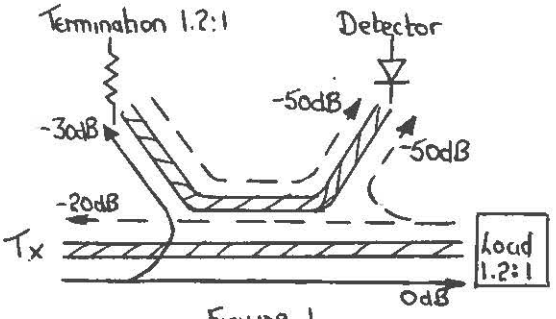


Figure 1

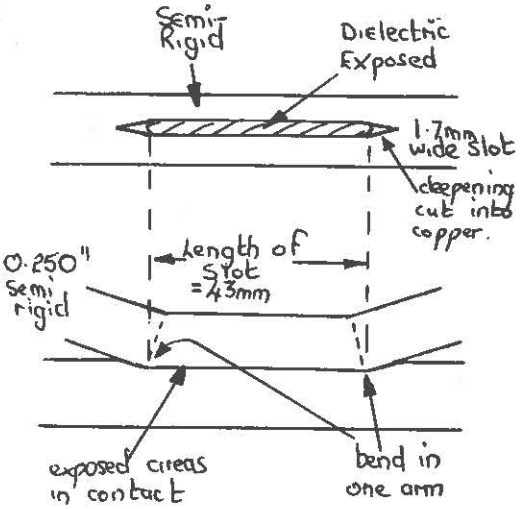


Figure 2

Figure 3

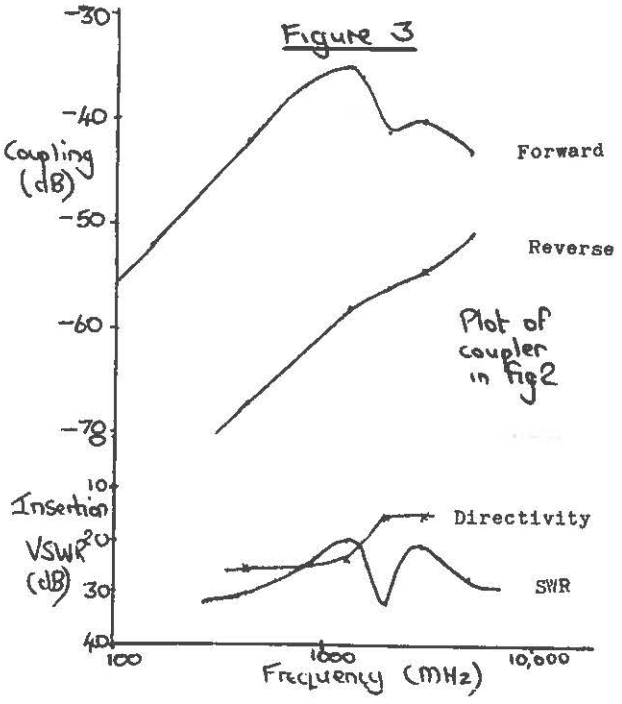
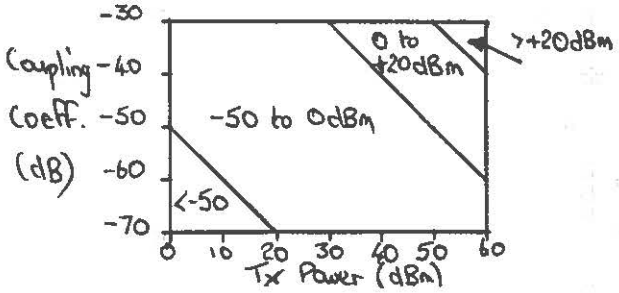


Figure 4



05/04/82

Here is some more information on the Alford Slot Antenna for 1.3GHz as described in Microwaves, August 81 (p732). See also the 02/82 issue of this newsletter for information on the balun. The antenna represents a very practical means of realising horizontal polarisation with an omni-directional pattern and very high gain on 1.3GHz.

Notes on construction

1. The semi-rigid feed/balun should be bent round after leaving the feed point so that it sits somewhere between the back wall and the centre as it passes down the tube. The exact arrangement is uncritical so long as the cable does not come too close to the slot and upset its operation (apart from the feed point of course). See figure 1.
2. It is not necessary to connect the cable to the inside of the tube as it passes out of the bottom. A convenient method of mounting, however, is to fit a shorting plate of some description across the bottom with an N-type plug or socket in it. The antenna can be mounted entirely by the N-type connector as shown in figure 2. This method is particularly convenient for mobile use when the N-type can be screwed on to a female back to back bulkhead N-type fixed in the roof. This feed-through in the roof can of course be used for other bands as well. Obviously many other methods of mounting are possible.
3. If the tubing used is a plumbing material then other fittings will be available. In particular a pipe blanking cap can be used at the base which will solder or clamp to the tube and in the centre of which an N-type can be mounted as suggested in 2. A common size of tubing available is 35mm central heating pipe, with 1.1mm thick wall (copper). This is suitable if the slot width is made 8mm and the length either 255 or 510mm for either the end or centre fed type.
4. The presence of moisture on the inside of the tube will not affect its operation, apart from the balun getting wet, which will introduce a slight loss. However water will accumulate in the tube and this is not desirable. The slot can be sealed with PTFE adhesive tape and a plastic cap can be used to seal the top in the case of the end fed version. An alternative approach is to enclose the whole assembly in a container such as a sealed length of plastic drainpipe. This method has been used successfully at G8JIOW.

Operation

Slot antennae are not new - a vertical half wave slot is equivalent to a horizontal half wave dipole and produces horizontal polarisation. The novel feature of the Alford is that by making the wave travel up the slot faster than light it is possible to obtain a dipole type field distribution over it's length which is many times longer than the free space half wavelength value. The net gain is similar to that obtained by feeding several dipoles in phase but is obtained without the need for a complicated phasing harness. The gain obtained is directly proportional to the length of the slot in free space half wavelengths.

The idea that waves are travelling faster than light would at first sight seem impossible but in fact it is only a standing wave pattern that appears to travel at this speed; the actual wave travels at a lower velocity than light. The velocity of the wave along the slot varies with frequency as shown in figure 3. This increase is very similar to that which occurs in waveguide near cut off frequency (F_{co}).

The slot behaves like a transmission line shunted by inductive loops (the solid cylinder is equivalent to an infinite line of closely spaced loops). Cut off occurs when the shunt inductance resonates with the capacitance of the slot. Below the cut off frequency waves cannot propagate at all. Above the cut off frequency the wavelength eventually decreases to the free space value.

In principal any velocity factor could be used but the higher the velocity factor (longer the slot) the more critical the dimensions. Velocity factors greater than about 10 are impractical for this reason and the normal operating range is around 5 to 15% above cut off ie with velocity factors of 2 to 5. In the designs given in the August microwave column the velocity factor is approximately 4. The gain achieved for these dimensions will be about 6dBi for the end fed version and 8dBi for the centre fed version.

The dimensions are, to a certain extent, interdependant. The velocity factor will be increased by decreasing the tube diameter, or by increasing the slot width. The wall thickness also has an effect since it determines the capacitance across the slot so that a thinner walled material will also increase the velocity factor. Thus if a slightly smaller diameter tube was chosen than one of the designs then this could be compensated for by using a slightly narrower slot so that the same velocity factor is achieved. Alternatively the length of the slot could be decreased. The antenna would then operate with a lower velocity factor but this would give a lower gain. For 1.3GHz antennae the tube diameter should, however, be within the range 31 to 39mm and any tube much beyond these limits will not operate correctly.

It is important that the operation is checked, particularly if any of the original design parameters are changed. This may be done by feeding the antenna with a signal at various frequencies and looking at the voltage distribution using a power meter, detector or analyser with a small probe to pick up the radiated signal (see figure 4). The probe should be held close to the tube, but not directly in front of the slot (hold it 20 or 30 degrees round from the edge) and moved along its length. The diode current meter described in 08/81 issue of the newsletter would be suitable for this purpose.

Mike Walters, G3JVL is continuing to experiment with Alford Slots and has a version working on 2.3 GHz which we hope will be published in due course.

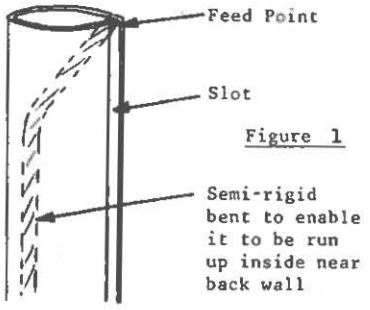


Figure 1

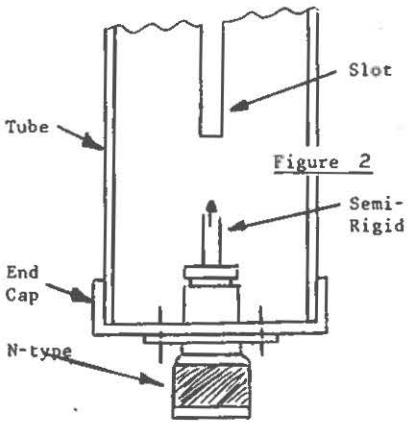


Figure 2

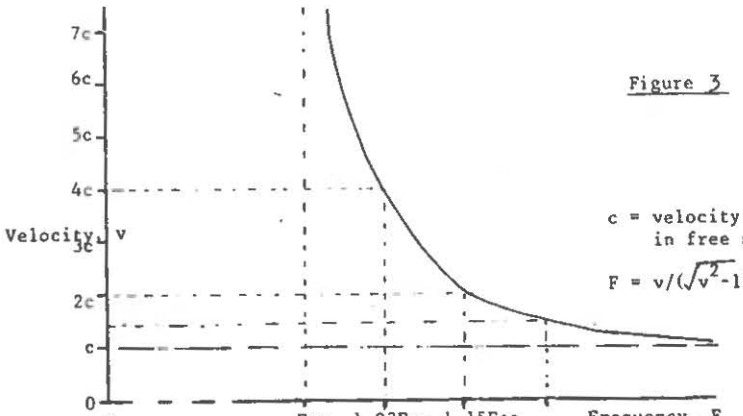


Figure 3

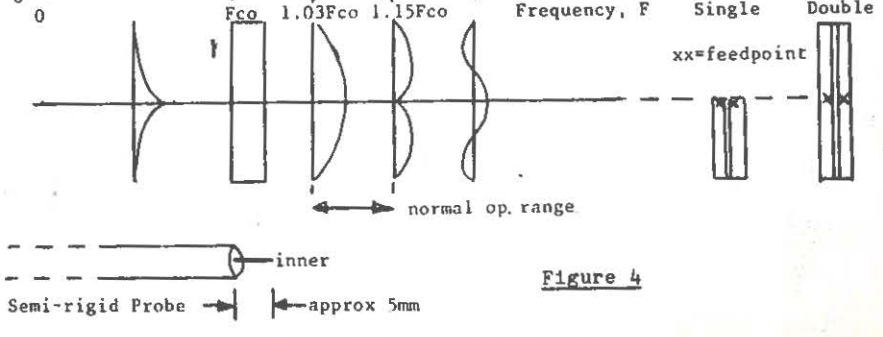


Figure 4

06/04/82

1.3GHz BEACONS

GB3AND ZL63B, Ikm E Andover, Hants
50W erp, Stacked Slots, 85m asl, omni, FI

GB3BPO AM77j, IOkm E Ipswich, Suffolk
700W erp, Slotted Waveguide, 80m asl, E/W, FI

GB3CLE YM48h, I4km NE Ludlow, Salop
20W erp, 2xI5/I5 yagis, 540m asl, N/SE, FI

GB3DUN ZL08e, 5km SE Dunstable, Beds
2W erp, HB9CV, 263m asl, N, FI

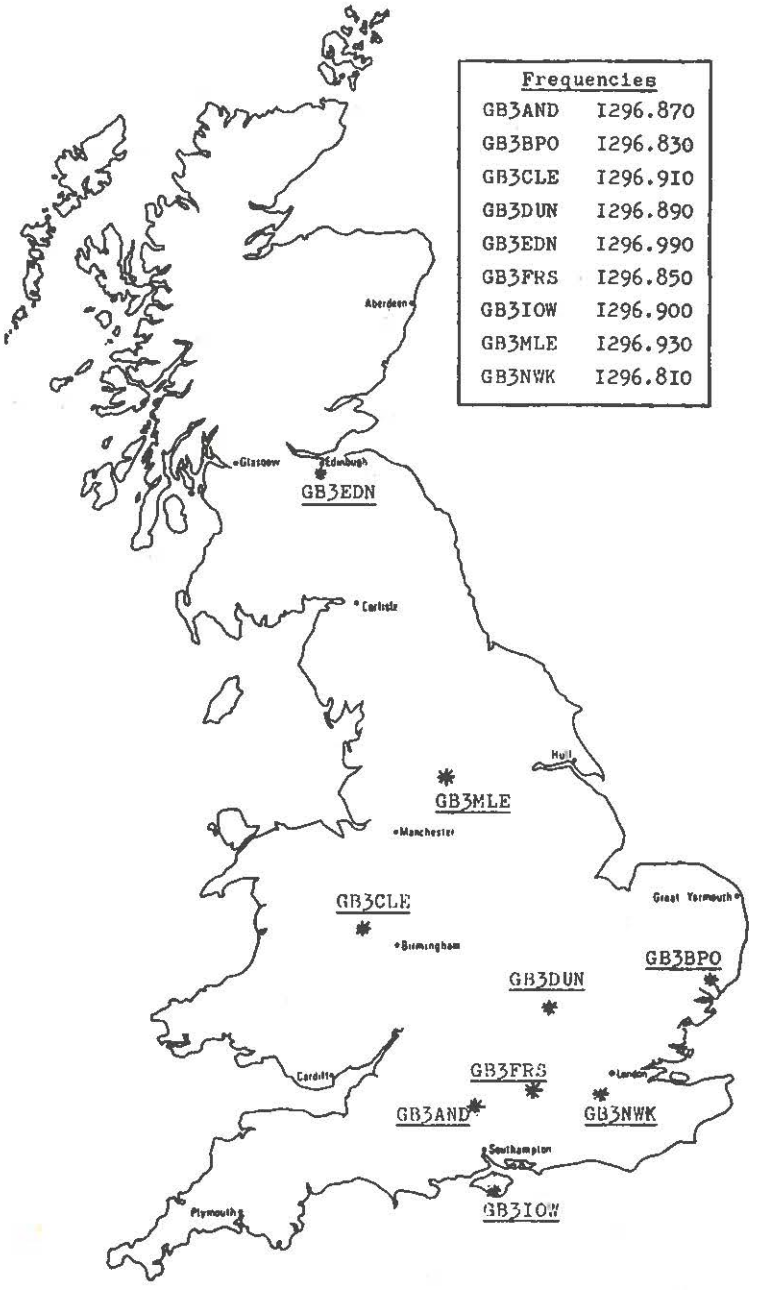
GB3EDN YP05g, 3km S Edinburgh, Lothian
25W erp, 2x corner reflector, II7m asl, NE/NW, FI

GB3FRS ZL57j, 4km NE Farnborough, Hants
3W erp, disc, I20m asl, omni, F2

GB3IOW ZK34a, I2km S newport, IOW
IOOW erp, Alford Slot, 250m asl, omni, FI

GB3MLE ZN32b, IOkm SE Huddersfield, W Yorks
50W erp, corner reflector, 600m asl, I60°, FI

GB3NWK AL5Ib, 4km SE Orpington, Kent
IOOW erp, 8/8 yagi, I80m asl, WNW, FI



Frequencies	
GB3AND	I296.870
GB3BPO	I296.830
GB3CLE	I296.9I0
GB3DUN	I296.890
GB3EDN	I296.990
GB3FRS	I296.850
GB3IOW	I296.900
GB3MLE	I296.930
GB3NWK	I296.8I0

Doppler Tranceivers for 10GHz

Heavy rain and weather fronts have been shown to enhance signal levels on 10GHz over obstructed paths by acting as scattering objects for the signals. When this happens the rapidly moving particles may spread a narrowband cw/ssb signal out over several kilohertz because of the doppler effect.

It is desirable to be able to detect this type of weather by using one's own equipment, without requiring a constant signal from another station. G4MBS has been doing this by using a low power narrowband transmitter at his home, and listening for it on a separate receiver using aerials with fairly broad beams. A scattering cloud can be heard either by the increased signal strength from the transmitter, or by listening for the doppler shifted components of the signal.

It occurred to G3YGF that it might be possible to use a much simpler setup for this purpose, such as a Gunn type intruder alarm, after being "detected" by one of these one day in a shop. It would probably not be quite as sensitive as the narrowband setup, but considerably simpler.

Doppler shifted signals will be seen only when the target is moving towards or away from the antenna, so the antenna should be angled upwards slightly for best results. A target velocity of 30 MPH will give an audio tone of about 600Hz, so any rain will be heard as signals in the low part of the audio spectrum. With a 20dB horn, it will detect cars at about half a mile range. Besides this use, G3YGF has discovered that quite a lot can be learnt about microwaves and standing wave patterns just by playing with a very simple rig such as this and observing various moving objects: cars, fan blades, birds, trees etc.

If a doppler module is not available, an existing wideband rig can very easily be modified by replacing the IF amplifier on the detector diode by the audio one shown in the diagram. The circuit has sufficient gain to drive a loudspeaker directly. The leads from the mixer to the amplifier should be kept short and screened to prevent hum pickup, and the supply may need more decoupling if it is noisy, eg a car battery when the engine is running. The frequency response extends down to low audio frequencies, and is probably limited by the speaker or headphones in practice. Slightly better results can be obtained by using a 3dB coupler in place of the 10dB one usually used in a receiver, as this gives a better compromise between the amount of oscillator power lost in the dummy load on the coupler and the amount of received signal lost in the oscillator.