Microwave Newsletter

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Microwave Newsletter 10-81 (December)

We would like to thank all those of you who have sent in ideas and information over the last year, and also thanks for the comments to last months questions. With your continued support the newsletter will continue in much the same format in 1982. NOTE: G3YGF is in the process of moving from Oxford, and his new address is not yet known. If required, he can be contacted indirectly via QTHR. So please send any news, technical items etc for the next newsletter to Steve Davies, G4KNZ at 10, Wilberforce Way, Bracknell, Berks. RG12 3PN.

Please note that subscriptions (£3 for 10 issues ie per year) should be sent directly to the General Manager at RSGB HQ. Please use a separate envelope for this purpose, clearly marking on the outside "Microwave Newsletter". Matters involving circulation are dealt with directly by HQ and any complaints of non delivery etc should be sent there for the attention of the General Manager.

There is a small demand for back issues, presumably for the technical items in them. Photocopies are available from G4KNZ (not HQ) at the above address. To cover photocopying and postage costs, 40p is requested for 1 issue, and 30p for each additional issue. We are also preparing a collection of the technical items from 1980 and 81, which will be about 20 or so sides of A4. Again this is available from G4KNZ directly and £1 should be enclosed to cover costs.

Conventions and Round Tables

Sheffield:

This was attended by about 20 people from Sheffield, Cheshire, Preston, Selby, Grimsby and Hartlepool. Barry G8AGN talked about UoSAT, and G3PFR demonstrated its 2M beacon received on an FT290 inside the lecture theatre. The rest of the meeting was centred on 10Hz.

For the benefit of the Grimsby group, who are all new to microwaves, there was a discussion centred around simple wideband techniques,and some equipment was demonstrated. G3ZIV demonstrated his narrowband 10GHz gear. G3PHO and G3PFR talked informally on the value of systematic logging and accumulation of path data whether the paths were worked or not. G3PHO also played recordings of GB3MLE on 10GHz from near Bradford.

G3NKL reported his fixed station work with G3FNQ which has been resumed after a move of QTH. After some difficulty in getting it going again, it it now working ok, and he reported weather effects such as rain scatter which were evident on the path.

Equipment available included a spectrum analyser, network analyser, noise sources, and a counter.

Martlesham:

This was attended by about 25 people, including a visitor from Belgium, ON6UG. There were two talks 1)"Equipment at 29GHz", by Bill Thorpe
2)"1.3GHz Repeater Technology", by Mike Walters, G3JVL.
In the first talk, we saw equipment that British Telecom were developing for low cost microwave links at 29GHz and in the second, Mike demonstrated some high performance waveguide filters for this band and explained the operation of the Alford slot antennas. Comprehensive test equipment was available, including a spectrum analyser, power meter, scopes, and a frequency counter. Much was also learnt about the pitfalls of noise figure measurement on their noise figure testgear!

Wolverhampton:

Although this was not primarily a microwave event, there was a display of microwave equipment, with working demonstrations of 24GHz wideband and 10GHz narrowband gear. G4CNV's JVL transverter for 5.7GHz was accompanied by G4ASR's gear which included a twt PA. A number of people showed interest in this exhibition, and we hope to be able to repeat this next year.

Many thanks to all those involved in the organisation of all the conventions for the time and effort they have given.

Christmas Activity Period (Sun 27th Dec):

G3PFR thinks that this is well worth trying, but wonders whether many xyls and families will agree!

G8AFC, G8AXE and G4BBU hope to be out on Winter Hill for the occasion.

GW4LXO hopes to be on Mynydd Maen, with 10 and 24GHz.

G3YGF may be on from somewhere near London, with 10 and 24GHz.

G4KNZ may be on from Lancashire.

10GHz Bandplan:

We (and the Microwave Committee) would be interested to hear peoples views on the current distribution of activity (wb and nb) over the band. Wide and narrow seen to have become quite widely separated, and there are wideband beacons both around 10100 and 10400. It would be a pity if potential QSOs were missed because peoples gear covered different parts of the band, and also less use will be made of some beacons if they are on out of the way frequencies. In practice, it is not very easy to make gear cover the whole band, and still work at its best. What say you?

News and Views:

Several replies have been received expresssing preferences for the technical content, and the value of the activity list. G3PFR says that technical matter for the 2.3, 3.4 and 5.7 GHz bands would be particularly welcome, and that the activity list is very useful to those up north, where they have a wide choice of sites, and may have to travel long distances to reach them. He thinks it is also very helpful to newcommers, of whom he hopes there will be a large number next season as a result of the PW exe.

Mike also hopes to have gear for 1.3 and 2.3GHz home or portable. He says these intentions are always good, but not always fulfilled! He wonders if anyone knows of a good reliable design for an easily built varactor tuned Gunn oscillator. This would be very useful for remote tuning, for example when the Gunn is mounted at masthead or on a chimney at home for short fixed station links. This mode of operation might encourage a number of beginners onto the band.

His other request is for someone to be prepared to make small quantities of small machined bits and pieces available, eg Gunn posts, chokes, varactor posts, tapered blocks, for 10 and 5.7GHz. Many people do not have access to the workshop facilities, and he thinks this would be a very valuable service.

Cliff, G8SHF has been making continuing progress with his VHF Comms 10GHz narrowband system. He is driving it with the Microwave Committee board which gives 250mW into a 5W PA at 340.8MHz, running into a X8 varactor as per P 136 of the VHF Comms design. He can get at least 1W at 2044.8MHz by using two BXY28s in series in this. This 1W is then fed into a snap diode to give 30mW at 10224MHz. When he feeds 144MHz into the snap as well as the 2044.8, he can get about 10mW output at 10368MHz.

G8AFC is currently building some narrowband gear for 5.7GHz and hopes to run several watts from a TWT eventually.

G3JVL has discovered some (unknown?) logic in the WR/UR numbering system for waveguides. The number is the inside dimension of the broad face of the guide in 0.010 inches. ie UR90 is waveguide 16, whose inside dimension is 0.9 inches... obvious once you see it! It also tells you the cutoff wavlength, as this dimension is a half of the free space wavelength at cutoff.

GB3BPO is still on 10368.830MHz, and beaming east from a 1 metre dish, but during some tests earlier in september it was heard by DK2ZF who was on the Danish coast.

He heard the signal at about 20dB over noise in a wideband receiver for about 20 mins, as a result of a ducting type enhancement over the 594km path. This just shows that quite large enhancements can occur even over such unpredictable areas as the North Sea.

Jonathan, GW4LXO was operating from Westbury White Horse during the last cumulative, and managed six qsos to stations on Hackpen Hill, Mynydd Maen, and Walbury. He did not hear any other stations at workable strength on the 2m talkback. He did not send in an entry, but says his total from the best three days was 1367.

He will be monitoring 144.33MHz when tropo conditions are good on the lower bands, but emphasises the need for people to call frequently (and a few kHz either side of the frequency in case calibrations are a bit out - YGF) as a few short calls can easily be missed, and it is no good just listening all the time. He says that the contact between F1BQ/P and GW3PPF/P would have been missed had this procedure not been adopted.

Jonathan is looking for 24GHz skeds, and wonders what would be thought of a 24GHz Cumulative contest now that a reasonable number of people have gear for the band.

He has built the 2C39 PA for 23cms as described in the VHF manual, including G4DGU's modifications in the Microwaves column, and found it was easy to build and set up but finds it rather inefficient- 600V at 70mA input giving 10W output!

He has an interesting suggestion that may raise a few eyebrows for a weekly net on HF, similar to the EME net as a means of exchanging info and skeds. Apart from the problems of class B licencees, it would probably give a much better general coverage of the country than 144.33, on eighty or fourty metres perhaps? Certainly two metres requires quite potent systems to give reasonable coverage, and is still very directional, which is not what is really required for this type of net. What are other people's views?

Roy, G8ASW (Birmingham) has become operational on 10GHz wideband using the PW exe, and has so far worked G3KPT over a fairly short path.

Gerry, G3KPT hopes to be out for the Christmas activity period. He has had quite a number of contacts from Barr Beacon, about 700ft asl, including G8AGN, G8ASW, G3PHO, G3ZME, G3YJH, G3MWQ, G8HMV, all portable, three squares in all. The take off from that site is ufortunately not very good to the south. He notes that Roy, G8ASW has a line of sight path from his home to Barr Beacon, and is willing to provide a signal if anyone requires one.

G8CIU, Chris, says that he has received no written reports of reception of GB3LDN. It has been operational since 1979, and any reports of either reception, or non reception within a range of about 50km of Sloates Hill would be very much appreciated. The beacon is running 5W erp from an omnidirectional aerial; its QRA is AL41A. He is also looking for someone to build a solid state PA for the beacon.

Petra, G4KGC reports that the tuning range of an IC202 can be increased considerably merely by altering the trimmers provided for the existing crystals. A range of about 1MHz can be obtained with one crystal, although the scale is then very non linear, each 10KHz division then varying from about 30kHz to 70kHz at each end of the scale. This mod is useful to overcome the limitations of a restricted tuning range on a 10GHz IF, for example.

RSGB Awards:

The following awards listed with their society terms of reference have recently been approved by Council:

1. Marconi Medal	Awarded for microwave equipment development, propogation investigation or other microwave innovations to Peter Tunbridge, G8DEK.
2. Mullard Award	Awarded for a significant contribution or new innovation which furthers the art of radio communication to Heath Rees, G3HWR.
3. Fraser Shepherd Award	Awarded for research into microwave applications to radio communication to Don Hayter, G3JHM.

1982 Cumulatives:

Again there are a total of six dates as per this year: 25 April, 16 May, 20 June, 11 July, 8 August and 19 September. See Radcom early next year for rules etc.

Microwave Committee Meetings:

Since I took over the Chairmanship of the Microwave Committee some three months ago I have realised that there is a need to communicate information about committee business to others interested in the microwave field. I therefore intend to write a short resume of each committee meeting which will be published in the Microwave Newsletter. To conserve space these reports will be brief - the meetings themselves often last five or six hours! As communication is a two way exercise I look forward to receiving comments from you, the readers.

Graham Murchie, G4FSG.

Meeting held on 24th October 1981:

We were very pleased to welcome the General Manager, David Evans to the meeting. Amongst topics discussed were the following: The recipients of the Marconi Medal, Mullard Award and Fraser Shepherd Award who are nominated by the Microwave Committee had been approved by Council (see separate item - editors). The committee discussed a paper on the method of working of CCIR (International Radio Consultative Committee, which is the technical organ of the ITU concerned with all radio matters). Any contribution to CCIR will need to be of the highest professional standard.

The Microwave Manager in a formal report observed inter alia that as microwaves is a minority interest in the RSGB and IARU we must continue to represent ourselves in the best possible fashion. Complimentary reports on the Microwave Newsletter had been received and the editors G3YGF, G4CNV and G4KNZ are to be congratulated. The circulation is approximately 80. The more useful articles are to be repeated in the Microwave Column.

A number of technical items were discussed (see elsewhere in the newsletter). Proposals for a 1.3GHz beacon (GB3FRS) at Farnborough and a 2.3GHz beacon (GB3LES) at Leicester had been submitted to the Home Office. G3JVL reported continued progress on the filters for 1.3GHz repeaters. 10GHz inputs to 70cm repeaters were discussed - each is to be considered on its merits (proposals please). Also 2.3GHz repeater proposals will be welcomed. 10GHz bandplans were discussed and views welcomed.

The recent Round Tables and Midland Convention were reviewed and the lectures for the VHF Convention were finalised (see elsewhere).

Graham Murchie, G4FSG.

VHF Convention 1982:

At the convention to be held on 13th March 1982 the Microwave stream will, subject to the agreement of contributors, be:

1. Solid State Power Generation at Microwaves
2. GaAs Fet Preamplifiers for the Microwave Bands (half hour)

and Implications of the New Microwave Bands (half hour)

3. 1.3GHz Mobile Systems

RSGB October UHF/SHF Contest:

The results for the microwave sections (ie above 1GHz) have just been received and are shown below:

1296 MHz Single Operator Section

1	G4KIY	3872 points	20 qsos	ZM40j	DK2UO	498 km	10 Watts
2	G8DIU	1734	22	ZL60h	G4CCH	238	25
3	G8GDZ	1106	12	ZM41g	G3TDG	186	25
4	G4LRT	930	13	ZM45d	G4CCH	124	30
5	G3SEK	269	5	ZL34a	G3SPJ	98	½
6	G8KAX	95	4	AL32g	G3TDG	31	3

1296 MHz Multi Operator Section

1	G3NNG/P	5951 points	45 qsos	ZL33h	DJ3ZU	554 km	20 Watts
2	G4BVY/P	4479	34	YM79a	DK2UO	620	20
3	G3ZUD/P	2744	28	ZM13d	G3XDY/P	194	150
4	G8GXE/P	930	10	YL29j	G3OSS	147	4

5769 MHz Single Operator Section

1	G8ADC	37 points	1 qso	ZL18b	G3BNL	37 km	10 Watts

10368 MHz Single Operator Section

1	G3YGF/P	190 points	2 qso	ZL15c	G3JVL	122 km	10 Watts
2	G4KNZ/P	74	1	ZL15j	G4MBS	77	10

73 de G3YGF, G4CNV and G4KNZ

The "Microwave Diary" has been held over to next month to fit in the contest news.

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1981 Cumulative Results

Position	Station	Points	Best Dx	km	qsos	Equipment
1	G3YGF/P	4564	G8FWA/P	179	48	WB & NB
2	G3ZME/P	2376	G8AGN/P	128	37	WB
3	G3YJH/P	2108	G8EUQ/P	152	35	WB & NB
4	G8AGN/P	2036	G3ZME/P	128	24	WB
5	G3WDG/P	1954	G3MTG/P	132	30	WB & NB
6	G4KNZ/P	1829	G3JVL	178	24	WB & NB
7	G4KGC/P	1793	G3MTG/P	132	28	NB
8	G3FYX/P	1746	G3PFR/P	91	28	WB & NB
9	G8HMV/P	1684	G8GUH/P	104	30	WB & NB
10=	G3IZD/P	1565	FOAKD/P	118	22	WB & NB
10=	G8SHF/P	1565	FOAKD/P	118	22	WB & NB
12	G4EBF/P	1493	GW3YGF/P	123	22	WB & NB
13	G3PHO/P	1461	G3ZME/P	128	16	WB
14	G3JVL	1318	GW3YGF/P	178	19	WB & NB
15	G3PFR/P	1195	GW3PPF/P	137	20	WB
16	G8EXL/P	1158	G8AGN/P	122	17	WB
17	G4MBS	1071	GW3YGF/P	149	18	NB
18	G3AYJ/P	837	G8FWA/P	95	17	WB & NB
19	F8WN/P	583	G3KSU/P	140	11	WB
20	G8GUH/P	454	G8HMV/P	104	6	WB
21	G4CNV/P	446	GW3PPF/P	116	12	WB & NB
22	G2DSP/P	396	G3KSU/P	70	12	WB
23	G4AUC/P	334	G3WDG/P	77	6	WB

Award winners are:

Leading Station	G3YGF/P	(Alpha award)
Runner Up	G3ZME/P	
Leading Overseas	F8WN/P	
Leading Fixed Station	G3JVL	
Leading Low Pwr WB	G3ZME/P	
Leading Station not having won an award before	G8AGN/P	

Check logs are gratefully acknowledged from G3KPT, G3LQC, G3MTG and G8CXK.

The following stations were noted as being active in the 10GHz cumulatives:
G2DSP, G3AYJ, G3FYX, G3IW, G3IZD, G3JHM, G3JVL, G3KEU, G3KPT, G3KSU, G3LQC, G3MTG, G3MWQ, G3PFR, G3PHO, GW3PPF, G3UKV, G3WDG, G3YGF, G3YJH, G3ZIV, G3ZME, G4AUC, G4BGP, G4CNV, G4EBF, G4GUN, G4KGC, G4KNZ, G4MBS, GW4LXO, G6BFV, G8ADC, G8AFC, G8AGN, G8BTY, G8CKV, G8CXK, G8CZE, G8DQQ, G8DTF, G8EQL, G8EUQ, G8EXL, G8FWA, G8GCP, G8GUH, G8HMV, G8IDZ, G8MCQ, G8MMF, G8MNY, G8MWR, G8NDJ, G8NNE, G8OWZ, G8PNL, G8PWI, G8SHF, G8SWZ, G8VZT, G8XMZ, G8ZPD, F1BQ, F1CIK, F1FYM, F3LP, F6DCK, F6DPH, F8WN, F9XG, FOAKD.

Comments:

1. Many people are not moving off 144.330MHz after having established contact with another station in the contest. Unfortunately the area around .330 is often rather crowded and many people move down to around 144.180MHz. In practice they may stay there for some time, often having several contacts before returning to 330 so perhaps the best solution is to shift the microwave calling frequency down to somewhere in this region. Has anyone any thoughts on this subject?
2. It was nice to see a high level of activity but a pity that more people did not send in entries.
3. There appears to be quite a high turn over in the callsigns appearing each year. It is nice to see new stations active but what is happening to the ones that are vanishing?
4. There appears to have been less activity across the Channel this year but a growth of activity in the Midlands.

Many thanks to G3WDG and G4KGC for adjudicating the results.

Gunn Diode Power Supply

There have been a number of designs and ideas for Gunn Diode power supplies in Radcom, the VHF/UHF manual and elsewhere. The following design is an attempt to collate these ideas into a simple, reliable and tested circuit requiring a minimum of commonly available components. (A PCB layout has been produced, and the PCBs are available from G4KNZ at a cost of £1.50)

Design:

1 The basis of the power supply is the 7805 regulator IC with a variable resistor between the common terminal and earth to make the output voltage adjustable in the range 6 - 9 V. It is also protected against output short circuits of short duration, but the heat sink is not capable of withstanding this condition indefinitely. Modulation from a mic amplifier or tone oscillator is applied to the common terminal of the IC via a capacitor. The level required depends on the Gunn voltage, but is typically from 10 to 100 mV peak to peak.

2 The mic amp is a single transistor circuit providing a gain of about 10 times, and is suitable for use with a low impedance mic.

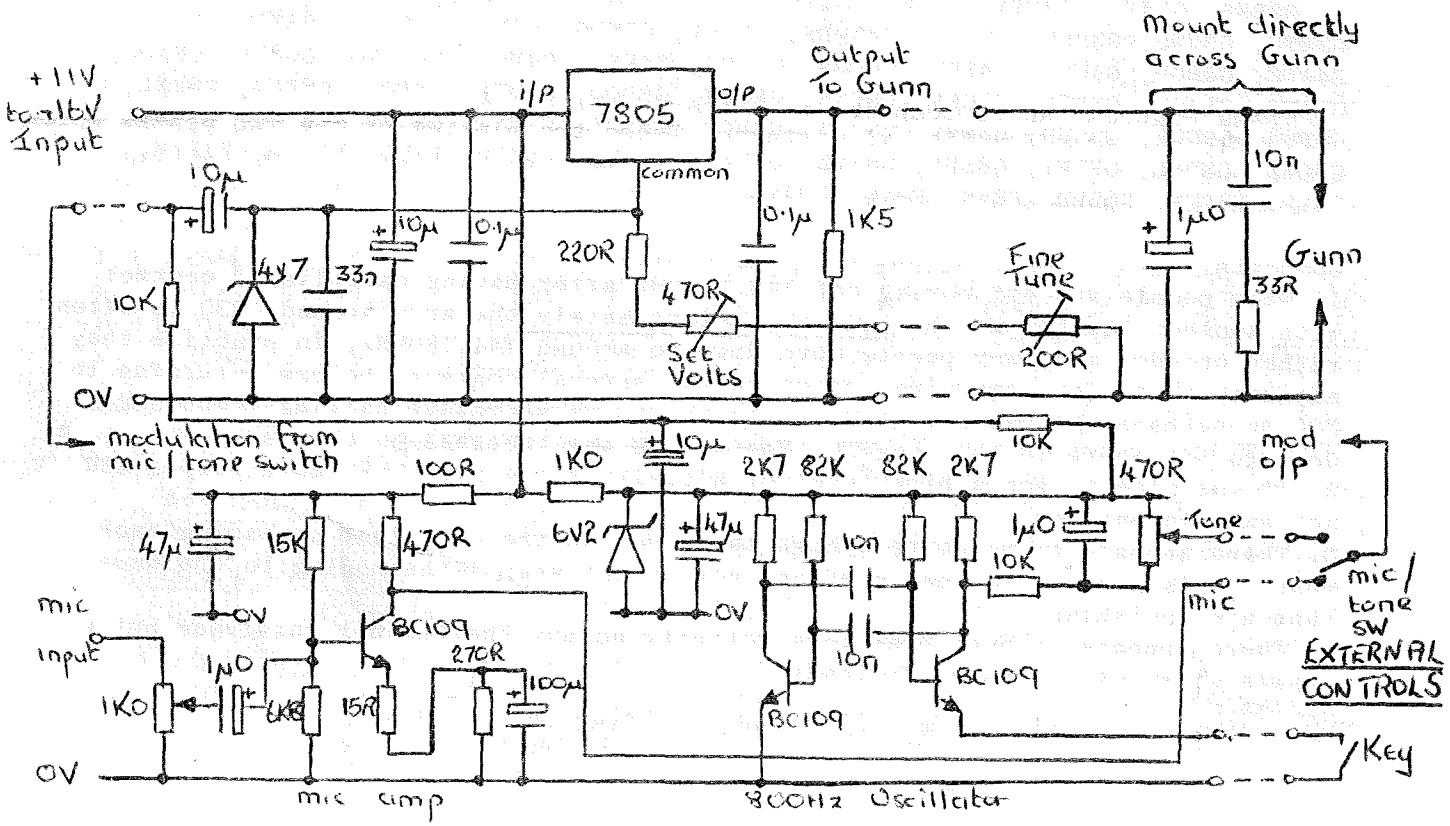
3 The tone generator is a two transistor oscillator which can be keyed on and off for CW.

4 Several decoupling capacitors and resistors in the supplies have been added to prevent noise on the power supply or tone from the oscillator from reaching the mic amp or the Gunn Diode.

5 Every attempt has been made to keep the circuit as simple as possible, and so no op - amps have been used. There are only two types of semiconductors used - the regulator IC and some NPN transistors, BC109 or similar.

The following circuit uses component values which will produce an output between 6 - 9 V. A preset on the PCB sets the approximate voltage, the external pot provides a fine tuning facility on receive and has a range of about 1V. Obviously the ratio of the values of these two pots can be changed to give a larger or smaller tuning range, but the total value should remain the same.

The PCB is double sided, with an earth plane on top, size 90mm x 45mm with mounting holes at each corner. The regulator chip is mounted on the board with a heatsink made from a piece of aluminium. This is ok for low currents up to about 200mA, but for larger currents it should be mounted on a sepatate heatsink, or the side of the box. If anyone wants a copy of the artwork to make their own PCBs, please contact G4KNZ.



07/10/81

Millimetric Bands

At WARC 79, amateurs were allocated five new millimetric bands - 47, 76, 120, 142 and 241 GHz. Although there is much still to be learnt on 24GHz and 10GHz, and indeed lower microwave bands, it would be a very worthwhile achievement simply to make a qso on these new bands. Very little information is available on designs for equipment and most of the initial work will be experimental. Here is a summary of some data and a few ideas for 47GHz and 76GHz in the hope that it will encourage a few readers into action building gear. Particular thanks are due to G3HWR for the absorption data.

1. WARC Allocations

47.0 to 47.2GHz exclusive

75.5 to 76.0GHz exclusive, 76.0 to 81.0GHz secondary

No news of availability in the UK yet.

2. Frequency of Operation

For crystal controlled equipment, a frequency of 76032MHz suggests itself, being 1152 times 66. No useful relation has been found for the 47GHz band (the nearest multiple of 1152 is just outside the band at 47232MHz) and the only suggestion is to use a multiple of 96MHz ie 47040 or 47136MHz.

A free running oscillator (ie a Gunn) on 47GHz would easily tune the whole band. On 76GHz, this probably would not be the case and so it might seem sensible to aim to operate fairly close to 76032MHz.

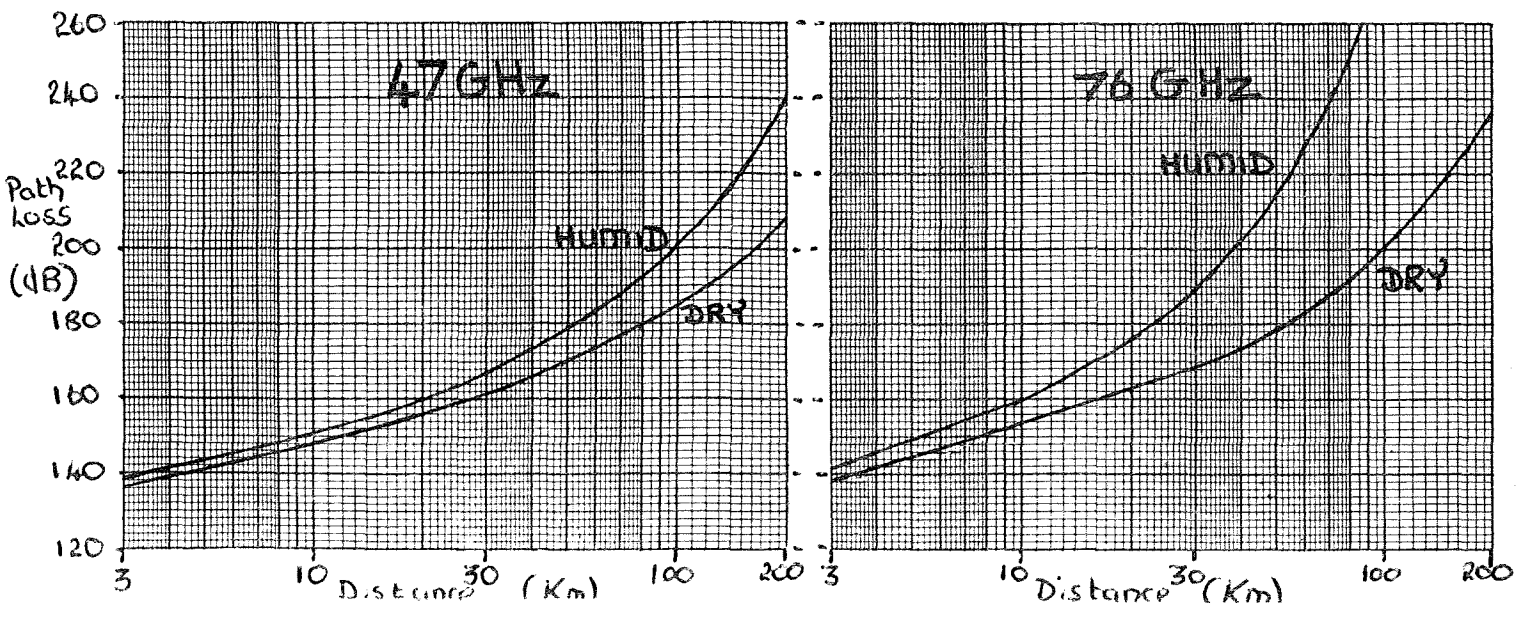
3. Atmospheric Attenuation

On the centimetric bands, any optical path in the UK can be worked with even simple equipment. This would also be true on 47GHz and 76GHz if it were not for absorption in the atmosphere. In dry air, absorption is mainly due to oxygen, but significant additional attenuation is caused by water vapour. What matters here is the absolute mass of water vapour present in the atmosphere so that attenuation may be more severe on a humid summer day than a wet but cold winter day. If the temperature is below freezing the water content of the atmosphere is very low - this might be the best time to operate! Some approximate figures for the attenuation and the comparative ones for 10GHz and 24GHz are shown below. These do not include rain across the path, which will cause the attenuation to increase very considerably at 47GHz and above.

Band (GHz)	Attenuation (dB/km)		
	Dry Air	Moderate Humidity	High Humidity
10	0.015	0.02	0.03
24	0.022	0.16	0.30
47	0.18	0.20	0.35
76	0.3	0.4	1.0

4. Path Losses

These figures can be combined with the free space loss to obtain approximate path loss figures as a function of distance. These are plotted on the two graphs below for 47GHz and 76GHz. The loss figures represent the loss between two isotropic antennas over the corresponding distance. Note that the humid air figures are for high humidity.



4. Ideas for Getting Started

The simplest suggestion is to use a mixer diode as both a mixer (on receive) and a multiplier (on transmit and receive) where the diode acts as a doubler or tripler. Thus on 47GHz a signal at 23.5GHz from either a Gunn or varactor diode could be doubled. This might be implemented using some sort of coupler arrangement, made from two different waveguide sizes (eg WG20 & WG24) with the mixer diode sitting in the junction. The IF could be taken from the diode to a conventional IF strip.

G3WDG points out that the output from a Gunn diode usually contains a considerable amount of the 2nd harmonic - it may only be 10 or 15dB down on the fundamental. Thus a GD033 module could be retuned to 23.5GHz and a simple filter placed on the output in WG24 to reject the fundamental. Thus a low power tx or local oscillator is easily built.

For an antenna gain of 37dB, which corresponds to a 3' dish on 10GHz, the dish sizes on 47GHz and 76GHz are 12 and 7 inches approximately. However, horns are quite practical antennas at these frequencies and are especially attractive as no critical feed matching is needed. The aperture sizes for a gain of 30dBi are 9cm by 7.5cm on 47GHz and 5.5cm by 4.5cm on 76GHz - similar in size to a 15dBi horn on 10GHz. These sizes will give a beamwidth of about 5 degrees, corresponding to a dish size of 18 inches on 10GHz.

The standard waveguides are listed in the VHF/UHF manual, but an alternative are the brass rectangular sections mentioned by G3HWR in issue 02/81. These are extruded sections used by the model trade available from R. M. Trading Co., 646 High Road, N Finchley, London N12 ONL, Telephone 01-445-6531.

Waveguide Switch

In VHF Comms, 1/81, there is a design for a waveguide switch as part of a 10GHz ssb system described there. Cliff, G8SHF has built a switch based on this design and found it very satisfactory. For anyone who has not seen this article, the essential details of Cliff's switch are shown here.

Two pieces of waveguide are butted together to form a V-shape which is then joined to a flange. A flapper is then placed at the intersection as shown in the diagram. This is allowed to pivot so enabling either of the waveguide branches to be selected from a common input, and this can be done manually or with an electric motor. In particular Steve, G4AUC suggest using a motor used to operate model railway points, such as the SM3. Cliff has used a Ledex switch coil, which gives about the right amount of travel, 28 degrees, but is rather heavy on current.