An Amateur Radio publication for the Microwave enthusiast

MICROWAVE NEWSLETTER

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FROM THE EDITOR

2002 – NOVEMBER/DECEMBER

As usual at this time of year, this issue spans November and December. The first Newsletter of 2003 is expected out around the 24th of January so if you have anything you would like included then you should ensure it reaches the editor no later than the 10th of that month.

The past few weeks have seen two superb microwave meetings, Microwave Update in the USA and the Martlesham Microwave Round Table over here in the UK. Both events owe their success to the hard work and dedication of the folk behind the scenes. Update takes around a year to organise so the 2003 event in Seattle, Washington, is already in preparation! A brief report on Martlesham appears in this issue and we will be describing what happened at Update in the January newsletter. Meanwhile you can get a more visual impression by visiting the World Above 1000MHz website (URL on page 14).

Our thanks this month go to Charlie, G3WDG for his 23cm PA article and to Dick , K2RIW. Dick is a mine of information, opinion and ideas. From time to time he posts items, on the WA1MBA Internet Microwave Reflector, that deserve a wider audience. His thoughts on feeding parabolic dishes are presented here in full and are well worth a read. Thanks again Dick!

The January 2003 newsletter will contain the annual contest calendar and rules, together with the latest Microwave League Table and All Time Squares/DX Table.

In this issue ...

News, views and articles for this newsletter are always welcome. Please send them to G3PHO (preferably by email) to the address shown below. The closing date is the Friday at the end of the first full week of the month if you want your material to be published in the next issue.

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or p.day@virgin.net

SUBSCRIPTION ENQUIRIES SHOULD BE SENT TO RSGB HEADQUARTERS AT THE ADDRESS SHOWN AT THE TOP OF THIS PAGE AND NOT TO THE EDITOR ..

FOR SALE AND WANTED

HIGH POWER AMPLIFIER PARTS FOR SALE

From: Dr Alex Gavva [alex@zcrb.kharkov.ua]
New Russian final parts (All prices are in American dollars):

TRIODES:

- **GS35b** 1500W@1000 MHz (close to 8877) - $105 ;1500W on HF,VHF,SHF, >800 W on 23 cm- RW1AW design.
- **GS9b** > 100 W on 13cm (K9EK cavity design) - $30. Ed builds finals with the GS9b.
- **GI7b** (350-300 W on HF to 23 cm) - $30
- **G811** = 811A

TETRODES:

- **GU84b** (2500W to 250 MHz)-$130. WA6PY designed 2kW 2m final-see internet.Sockets are available-ask. OK for HF-VHF.
- **GS15b** 280 W on 23 cm in WA9OUU cavity design – $25
- **GU43b** 1600 W up to 100 MHz - $50. Are ok for HF-6m, similar to 4cx1600
- **GS23b** 1.5 kW on 70 cm in N7ART and KD5FZX finals (very similar to YL1050) $150
- **GS36b** = 4cx400a – $50
- **GU74b** = 4cx800a – $70

RELAYS:

- **REW-15 coaxial 1500W relay** - $20, connectors for them, $1 each - http://www.nd2x.net/rew15.html
- **Inexpensive HV (6-10-20 kV) RF disc ceramic** and doorknob capacitors (470,680,1500,2200,3300,4700 pF) - ask.
- **Zener diodes D815A** 5.6 V @1450 mA(8W) - $0.25 per each.
  D815B 6.8 V @1150 mA(8W) - $0.25 per each
- **Vacuum variable capacitors**: 5kV, 4-260pF -$50

NOTE:
- All parts are new, newer used.
- All prices on tubes,relays, vacuum variable capacitors
  included postage.
- Delivery period about 2 weeks.

73 from Alex,UR4LL. **[alex@zcrb**.kharkov.ua]

FOR SALE:

One 70cm Power amplifier for EME use. PA consists of a 7651 valve with 2 spares. Output approximately 750watts .Power supply required. Can possibly deliver Norfolk -Suffolk area.
Offers around £50.
Please contact me on 01255 425965 evenings .
Gus Coleman , G3ZEZ, (QTHR)
[Gus.Coleman@ra.gsi.gov.uk]

Are you interested in the 76GHz band?

But the size of the diode and the problems of mounting it put you off ...
Also the problem of obtaining sufficient power at 38GHz to drive the mixer...

To try and encourage more activity on the band and help with getting the above problems sorted I am looking for amateurs who would be interested in the following package

1) DB6NT Mixer PCB fastened into a milled enclosure with the diode mounted and SMA connectors for the LO input and the IF connection. Size approx 45x45x22mm

2) X 3 multiplier module to give 38GHz (@ 10mW output) when driven with 12.6GHz (@ 40mW input)

3) Not all of the work is done for you – you will have to make a transition from the rectangular face of the X3 unit to SMA to feed into the mixer and construct your own IF strip (DB6NT)

At this moment in time I am looking for numbers who are interested in this project to contact me – numbers are limited so first come first served. When these are known, costing will be worked out and passed onto interested parties.

You are not required to send any monies yet as the big unknown is the cost of the machining this depends on the quantities required.

This is a once only project when we have reached the limit that's it.

Interested Amateurs can contact me (Martin Farmer) either by post (QTHR) or Email at :

g7mrf@compuserve.com

SEE PAGE 10 FOR A PHOTOGRAPH OF THE MODULES

MARTLESHAM 2002 ... was a resounding success, with an attendance of around 100 microwavers. Excellent talks, by Grant, G8UBN, Chris, GW4DGU and Paul Wade, W1GHZ, were very well attended by appreciative audiences. G3PHO reviewed microwave activity 1997-2002 and gave an outline of next year's contest calendar. The Bring and Buy saw some good trading. Martklesham is now a two day affair. On Saturday, some 32 folk were treated to a fascinating tour of the RAF Neatishead Radar Museum, the oldest radar station in the world. That evening many gathered for an excellent dinner at the County Hotel, Copdock. Sunday was the day for antenna tests, lectures, Bring and Buy and equipment testing. **The noise figure tests are shown below**. Many thanks to G3XDY and all the folk at Martlesham for putting on such an enjoyable "do". Make sure you are there next year!

Noise figure results
Martlesham Microwave Round Table 2002
10-Nov-02

Band	Callsign	System	Gain (dB)	NF (dB)
144	G3LTF	NE33218 DJ9BV Dubus 1/93	21.7	0.45
432	G3LTF	FHX35LG/ATF10135	39.8	0.40
	G3LQR	DJ9BV FHX05	20.2	0.70
	G3LQR	MGF1302	19.8	1.08
1296	DB6NT	DB6NT 131 AH HEMT	21.7	0.32
	G3LTF	DJ9BV FHX35LG & ATF10135	37	0.44
	G3LTF	ATF36077 & ATF10136 W5AGO board, Cavity I/P	32	0.36
	G3LTF	FHX35LG & Red spot W5AGO "dead bug"	40	0.35
	G3LTF	ATF36077 untuned stripline input	12.85	0.60
	G3LQR	ATF36077 & ATF13136 WD5AGO board	34.9	0.92
	G3LQR	NE32585 & 2nd stage	17	0.70
	G3LQR	MGA85563 MMIC	14.4	3.55
2320	G3YKI	Broadband MIMIC Preamp	18.9	3.60
	G3LQR	NE325	14.9	0.60
	G3LQR	MGA85563 MMIC	18.4	2.61
	G3LTF	ATF36077	19.2	0.46
	G8UBN	ATF54143 + MGA85563	31	0.60
	G3LQR	FHX06	11.1	1.00
2400	GM4PLM	California Amplifier downconverter	31.6	1.80
3400	G3XDY	DB6NT transverter (inc relay)	21.6	0.98
	G3YKI	Broadband MMIC preamp	21.6	2.97
5760	G3XDY	Transverter DB6NT (inc relay)	20.6	1.30
	G4BRK	Preamp NE32584	20	1.63
10368	G3XDY	Transverter DB6NT (inc relay)	21.55	1.69
	G4EZP	Preamp DB6NT kit	20.6	1.58
	G4EZP	DB6NT preamp 102A	27.2	0.83
	G4BRK	MGF4917	11.5	1.04
24192	G4BRK	DB6NT preamp & transverter (inc relay)	24.7	4.85

A New 1.3GHz Power Amplifier Development

A new solid-state PA for 1.3GHz is currently being developed by G3WDG. The new design uses a modern single transistor as the active element. The saturated power output is in the region of 50W, with a 1dB gain compression point of 35-40W. To date, this level of power output has only been achievable with 2 x M57762 Mitsubishi modules, which are no longer being manufactured.

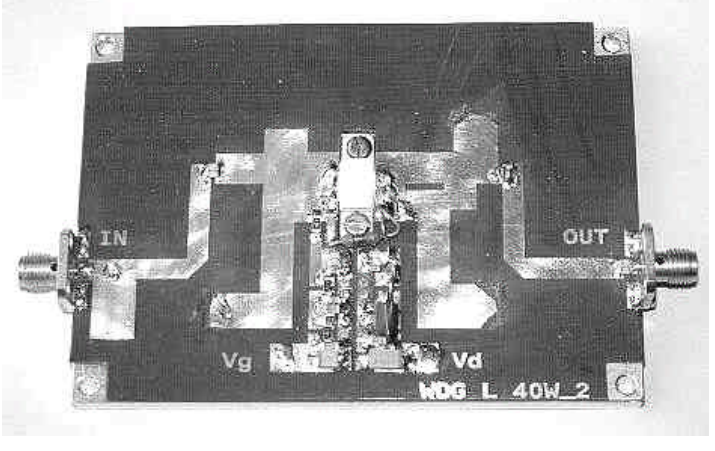
To date, three prototypes have been built, all of which have exceeded 50W output power. Small signal gain is in the region of 18dB, meaning that the PA can be driven to nearly full output power with only 1W drive. One departure from most existing solid state designs is that the PA uses a 24-28V supply, meaning that much less current is required than with even a single M57762, making the amplifier a better candidate for mounting at mast-head. The 28V supply can either be provided by a normal power supply or with two lower voltage supplies operated in series (assuming a non-grounded output for one of them). A 12-28V switched mode supply would be another option. The efficiency of the PA is much better than the M57762, meaning that less heat is generated.

The PA uses a low-loss teflon PCB, to minimise losses and ensure that the design is reproducible. The amplifier is optimised for 1296MHz, but can also be used at 1269MHz with a small loss in performance, but extra stubs are provided on the pcb to allow the performance to be optimised at 1269MHz (eg for uplinking to AO-40). Operation at other frequencies in the band has not yet been tested – any specific applications (eg TV) should be able to be catered for.

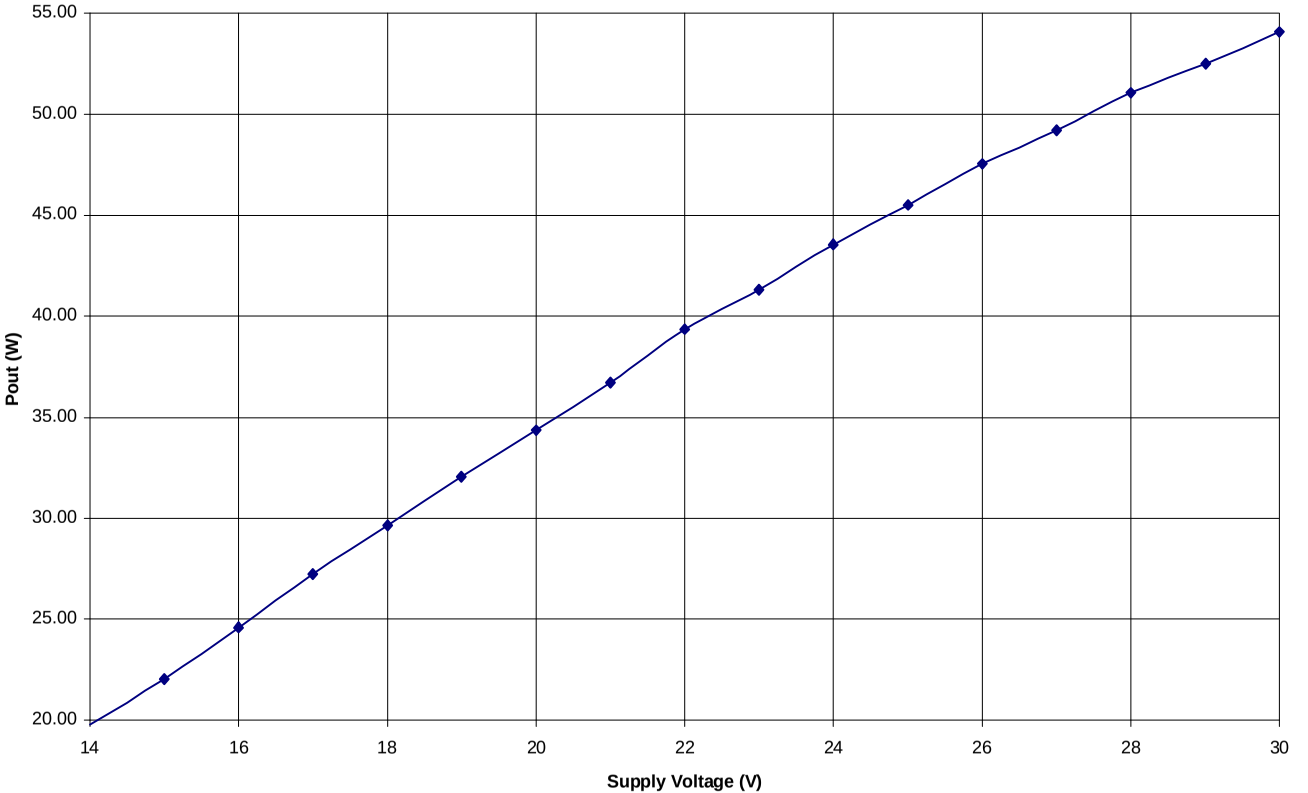
Currently the prototypes are undergoing on-air tests and, if everything is satisfactory, the design will move into beta testing in the very near future. In the meantime, G3WDG has a few of the prototypes available for sale (ready-made with SMA connectors). If you are interested in these, or participating in the beta test phase, please contact G3WDG at charles.suckling@ntlworld.com or phone 01933 411446 (evenings – please leave a message if engaged).

If the development is successful, it is hoped to make kits, and possibly ready-made units, available early in the New Year.

A photo of the latest prototype is shown below, together with some performance information.



Power Output (W) v Supply Voltage (2W drive)



Dish Under-illumination, F/D, G/T, Phase Centre and Related Topics ..... by Dick, K2RIW

Warning! This is not a brief memo (I've got lots of strong feelings on this subject). However, after my errors are corrected, I hope my opinions on the operation of Parabolic Antennas will be helpful to those who care to read this.

Introduction -- I have had a rather close and hands-on relationship with Parabolic Dish antennas since 1968, when I scratch-built my first 12 footer -- "A 12 Foot Stressed Parabolic Dish," (QST, August, 1972, page 16 and on the cover, by K2RIW)

On the WA1MBA Internet Microwave Reflector, Zack, W1VT, asked a simple but provocative question about under illuminating a dish as a method of beam broadening. I call this a "Zoom Control." I have used a Zoom Control for four and a half years, with great pleasure, on my 432MHz array of 16 yagis (19 elements each = 304 elements total) on a 100 foot tower. The use of electronically selectable beamwidth broadening during a contest operation can greatly increase the fun and eliminate many of the azimuthal ambiguities.

Zack's fascinating question kicked off a series of 19 Microwave Reflector responses by K2TXB, G4BRK, K5TR, WA5VJB, W0EOM, KD7TS, KJ4SO, W6CWN, K0CQ, WA2SAY, W7CS, and AL7EB, in that order! Each of the responses contained vital "pieces of the puzzle" but few of the responses would give a newbie a "warm feeling" for what is happening within that modified Parabolic Antenna. Arguably, the most important and popular type of Microwave antenna is a Parabola.

We all want more, new and skilled Microwave operators -- so as to preserve our valuable spectrum, as well as other reasons. For this to happen we must remove some of the mystery about this valuable antenna type. Once learned, many new and crafty operators will "see" new antenna possibilities within every hardware store (such as Home Depot). This memo is my attempt to fill some of that void. Please read also, W1GHZ's On-Line Microwave Antenna Book.

The following seven sections try to explain:

(I) The Focusing Action of a Parabola (and its cousins, the Offset Parabola, Ellipse, and Circle),
(II) The two meanings of The Parent Parabola,
(III) The effects of Axial Horn Movement (Prime Fed Dish),
(IV) Axial Horn Movement (Offset Dish),
(V) Non-Axial Horn Motion (two types),
(VI) Gain Maximization
(VII) The W2IMU Horn Modification Problem.

(I) Focusing RF Energy -- During reception, every antenna we use has a certain "capture area" wherein the antenna gathers and focuses the RF energy onto a "driven element," "feed horn," or similar structure that supplies the "gathered RF energy" to the transmission line. In the case of a Parabola, that "gathering," and "Focusing" (if done efficiently) involves at least TWO coherent functions -- (1) having the correct surface orientation (angle of incidence equals angle of reflection), and (2) obeying the correct phase length (path length). If used correctly, the so-called "conic sections" do this very well.

I'll first give three conic section examples (ellipse, circle, and parabola) to illustrate this, as a kind of thought experiment:

Example (1) Ellipse -- Assume I have a (slightly isotropic) point source RF emitter that's located at the transmitter site, in my back yard, and I wish to capture all it's output at a receiving site, that's 10 feet away. There is one surface that does this perfectly, it's an ellipsoidal surface; it would look like a large, reflective, egg, that's placed around the two sites. That's a three dimensional (3D) ellipse, or an ellipse of revolution about the major axis. I'll boil this down to a 2D discussion. Assume I have placed a vertical sheet of metal through the two sites and I'll analyse the shape of the ellipsoid that touches the sheet (it's a 2D ellipse).

If the ellipse was placed at the coordinate centre, the equation of the 2D elliptical reflector would be (X/a)^2 + (Y/b)^2 = 1, where a and b are constants that define the shape and size of the ellipse. The ellipse has two foci (focuses); each one is located at one of the sites (transmission and reception). The ellipse has a property called eccentricity, (e = 1 - (b/a)^2), which is less than 1 and somewhat proportional to the distance between the foci.

The magic of the elliptical surface is that it meets the TWO conditions -- (1) every square inch has the proper surface orientation to reflect the energy in the correct direction, AND (2) every possible path taken from the transmitter site to the receiver site (with one bounce) has exactly the same path length. That means that the ellipse (ellipsoid) will gather ALL the transmitted energy (from all of 3D space) and focus it (all in phase) at the receiver site. To me, that's kinda neat. By the way, ellipsoidal reflecting surfaces have often been used to focus almost all of the exciter energy of a laser pump onto a laser rod.

Example (2) Circle (Sphere) -- Now let me slowly move the transmitter closer to the receiver, while continuously changing the reflecting surface, so that I can keep gathering all the RF energy. In the limit, the transmitter and receiver will be collocated and the reflecting surface will become a sphere (a circle on my sheet of metal), where a = b in the ellipse equation -- the eccentricity has gone to zero, and the two foci have moved together.

Example (3) Parabola -- Now let me move the transmitter site off to an infinite distance, while continuously changing the reflecting surface, so as to keep gathering all the RF energy. In the limit, that surface will be a Parabola, which is merely an ellipse where the (a) dimension has gone to infinity in the ellipse equation; the eccentricity is 1.0. With a little rearrangement, the equation takes on the familiar form, Y^2 = 4(f)X , where f equals the focal length and Y is the dish radial dimension.

Notice that a parabola (for an infinite distance) and an ellipse (for a close distance) are related, but slightly different curves. This may give you some feeling for why there is such a thing as a "Near Field Range" for a parabola (R=2D^2/lambda), where D is the dish diameter and R is the range. If you attempt to make Parabolic Antenna measurements within that range (or closer), the surface shape is sufficiently far from the correct elliptical shape that the RF energy starts focusing slightly out of phase and you start getting a noticeable degradations in pattern and gain. The first sign of this is that the first null in the antenna pattern (between the main lobe and the first side lobe) disappears.

Moving the feed focal length further away from the dish gives you a slight improvement in the Near-Field Focusing errors, but it does not accomplish a complete correction -- only reshaping the reflector into an ellipsoid would do a perfect job.

(II) The "Parent" Parabola -- This phrase has at least two meanings:

Meaning (1) -- Notice that the basic equation of a parabola always goes to infinity in the multiple directions (X and Y). When we decide to build a Parabolic Dish Antenna, we are deciding to build a reasonable portion of that complete Parabolic curve. By choosing the focal length (f) of our Parabola we are choosing whether the portion we build will be a deep dish or a shallow one -- each has it's advantages. Selecting the focal length (or the F/D) merely selects the radius of curvature (at the apex, for instance). If we cut away some of the reflector, or electrically do a similar function (by under-illuminating), we are not changing the true focal length (radius of curvature) of the Parent Parabola.

In all cases, a well-constructed Parabolic Reflector has ONE FOCUS for all frequencies and dish diameters (when using the same Parent Equation [focal length]). Many amateurs erroneously think that the focal length changes with the frequency or the portion of the surface that is constructed (or illuminated).

Meaning (2), Offset Reflectors -- When we construct a round shaped Parabolic Reflector with the Parabola Apex in the centre, this too can be called the "Parent Parabola." We can then choose to "cut away" an off-centred portion of the reflector, leaving a round (or slightly oval) "Offspring" that includes the apex and one side of the perimeter. That new surface is an Offset Parabolic Reflector. Notice that the Offspring now has a non-symmetric surface that's more curved at the position of the

apex of the Parent Parabola (this difference is rather subtle to an unaided eye). Also, there is only one position (spot in 3D space) where the reflector focus is located; you can not rotate the Offset Reflector and leave the feed horn in the same position -- the non-symmetrically curved surface will not focus properly.

One of the well kept secrets of almost all the manufactured Offset Fed Parabolic antenna systems, is that the Offspring Reflector includes the Parent Parabola's apex (centre of the original Parent Parabola. The result of this is that you can now easily determine the elevation aiming point. Merely sight from the apex edge of the dish (the part closest to the feed) through the phase centre of the horn; that's the antenna's boresight. If that turns out to not be true, than most likely you are using the wrong focal position. This became apparent when a number of 10GHz operators started using the same 18" Offset Fed Dish on 24GHz. The dish efficiency was quite low, until they determined the "true" focal position; the shorter wavelengths made this more critical. When they then went back to 10GHz, they discovered a slight increase in efficiency with the "corrected" focal position.

An Offset Fed Parabolic antenna system has the feed horn phase centre placed at the same focal point as the Parent Parabola (it didn't change because of the off-centred cut away). However, the Primary Feed Pattern would now be illuminating areas where the Parent Parabola, was cut away (that would be wasteful). Thus, the feed is re-aimed (but, not translated) at approximately the centre of the remaining Offspring Reflector -- keep the phase centre in the same place. This gives the best (and a higher) efficiency, because now the feed horn is not causing a blockage and the spill-over (and feed side lobes) are usually illuminating cold space, and thus not contributing much to the system's noise temperature.

III Shifting The Feed, Forward and Aft (Prime Fed Dish) -- When we move the feed horn along the axis of transmission (in a prime-fed Parabola) we are shifting the focal distance, but we are creating a spherical aberration (a kind of defocusing). Moving the horn outward causes the emitted signal to have a concave wavefront (viewed from a position that's in front of the dish system), and it "Focuses" at a distance closer than infinity (it becomes near sighted). I use the word "Focus" in quotes because, as previously explained (in Section I), this is only a partial phase correction. It makes an improvement for a close emitter, but the technique can only be carried so far. You can't use this technique to get a good focus on a 10GHz 3 foot dish at an emitter distance of 10 feet (mathematics to be supplied later).

Moving the horn inward of the calculated focal distance causes the emitted signal to have a convex wavefront and now the dish is "Focused" beyond infinity (it becomes far sighted).

The horn inward moving technique is a coarse method of "Beam Defocusing," or "Beam Broadening" that could be used as a Zoom Control. It causes a more spherical wavefront (lowers the gain), and simultaneously causes the desired under-illuminating function required for a broader beamwidth. There will be some side-lobes developed, but they may be very tolerable; their magnitude is partially dependent on the system's F/D ratio, as well as the Feed Horn characteristics.

IV Shifting The Feed, Forward and Aft (Offset Fed Dish) -- However, the axial motion (along the boresight) of the feed horn will have a different effect on an Offset Fed Parabolic system. It will simultaneously cause Squint. That's a fancy way of saying that the boresight will shift. The direction of shift (squint) is fairly easily predicted (with slight inaccuracy) by knowing that (in general) the angle of incidence equals the angle of reflection.

V Shifting The Feed, Non-Axially (Offset & Non-Offset Fed Dish) -- I believe that there is a way of intentionally de-focusing an Offset Fed Parabolic system by moving the horn inward along the axis of the horn. This will slowly (because of the larger F/D ratio) cause a convex wavefront (front view) and, again, it will cause under-illumination -- both are in the desired direction for beamwidth broadening. There probably are past references on this subject but, even if there aren't any (for an Offset Fed system), microwavers are becoming quite proficient with fancy modelling programs; this would be a great place to do some pattern/gain modelling. Or, simply make a "Leap of Faith" -- go do it (try it, you'll like it)!

For a Prime Focus Dish, there is a considerable amount of beam steering that can take place by only moving (translating) the horn in a transverse manner. In the Radiation Laboratory Series of Books ("Microwave Antenna Theory and Design," #11, McGraw-Hill Book Co., NY, 1949, by S. Silver) the author states that the boresight can be steered by six beamwidths, before the gain falls off by 1 dB, if a 0.6 F/D reflector is in use. The problem becomes worse for lower F/D ratios. **This suggests that a cluster of almost 6 horns, side by side, is possible if a 0.6 or greater F/D is in use.**

I believe that an Offset Fed Parabolic Antenna system will be even more forgiving, when transverse horn motion is used (in azimuth or elevation). This is because of the large F/D ratios that most of them posses. This suggests that a whole cluster of horns is possible, with a rather small gain sacrifice. The only disadvantage may be that a predictable amount of dish re-orientation will be required when a change in horns is initiated.

VI Gain Maximization -- Step One in the process of maximizing the gain of a parabolic Reflector antenna system is understanding the Geometry. This means:

- (A) Is the reflector the correct shape and smooth enough for the wavelength in use? If not, can it be re-shaped; can the dents be hammered out, etc.? The Johnson, "Antenna Engineering Handbook", McGraw-Hill, 1992, has curves that predict the rate of gain fall off versus reflector errors (bumps).
- (B) Is the reflector's mesh fine enough for the wavelength in use? Should it be covered over with a finer mesh? Johnson (ibid) Handbook has prediction curves.
- (C) Has the proper feed horn focal position been found for the reflecting surface in use? By measuring the diameter (D) and the depth (d), and applying the formula, F = (D^2)/16d , this can be found for a Prime Focus Parabola. For an Offset Fed Parabola, the problem is a little more difficult. W1GHZ's web site will help. Even by pure experimentation, it can be found.
- (D) Has the system's F/D been correctly determined (this is required to design/ build the proper feed horn)?

Step Two -- The next step is choosing the best Feed Horn to properly illuminate that Parabolic-shaped Reflecting surface -- this is a slight compromise. Do you want the maximum Gain, maximum Efficiency, or best Gain to Temperature (G/T) Ratio?. Most of us want the first two (they're very close). An EMEer will want the best G/T.

Well, where does the best Gain come from? If this was the best of all worlds, your Feed Horn design would apply an equal amount of RF energy (in phase) to every square inch (or square cm) of the reflecting surface (including the extra path loss to the dish perimeter). That Primary Feed Pattern would abruptly fall to zero at the edge of the dish -- there would be no spill-over energy. Such a Primary Feed Pattern would yield a reflecting surface with 100% aperture efficiency, and the G/T would be ideal.

Believe it or not, those feed horn characteristics are almost achievable. BUT, to have that high a Directivity and Pattern Control, such a horn (or a cluster of horns in a Phased Array) would be larger than most of the Parabolic Reflectors we have ever used. In a Prime Focus Parabolic System, that ideal horn would block out the whole reflector! Even in an Offset Fed Parabolic system, if your horn has more gain than the reflector, skip the reflector and simply aim the horn at the target!

So, for a bunch of reasons, we choose the best realistic horn we know of (Chaparral or Dual Mode [W2IMU] if your dish is near a 0.6 F/D) and adjust them for either a -10 dB, or -20 dB edge illumination taper. The two horn types (Chaparral and W2IMU) are really a multi-element type of feed that have a very desirable pattern, almost no edge currents outside the horn, almost no side lobes, and they have a nearly constant point source phase centre versus azimuth, elevation and diagonal observation angles.

Bear in mind that a subtle shift in the emitted phase from your horn, as a function of a change in observation angle, causes the same system degradation as if your reflector had a big dent in that area. It's hard to believe that some beautiful-looking Parabolic Dish Antenna systems can have a serious error that an untrained eye can not see.

A lot of experience has shown that the best gain occurs at about a -10 dB edge taper (nearly the best illumination taper), and the best G/T occurs at about a -20 dB edge taper (a kind of under-illumination). The gain changes rather slowly (at first) as the illumination taper is changed. The most sensitive characteristic is the first side lobe levels -- they can be as low as -25 dB (or better) with a -20 dB edge taper.

VII W2IMU Horn Modification Problem -- I have read of enthusiastic builders who changed the length or diameter of the large-diameter section, or the diameter of the smaller section, of the W2IMU Dual Mode Horn, as a way of controlling the horn's beamwidth, so as to adapt it to a dish that has an F/D that's quite far from (the designed) 0.6. This can be a disappointing endeavour. Yes, the Dish is not going to crash and burn but it may have a disappointing efficiency (or pattern) result.

What Dr. Dick Turrin, W2IMU, did in that horn design was to set up the two circular waveguide modes (TE11 and TM11) in just the right amplitude ratio and phase relationship that the resultant at the horn throat has virtually no edge currents to cause sidelobes and back lobes. This also causes the horn to have a constant point source phase center versus all observation angles.

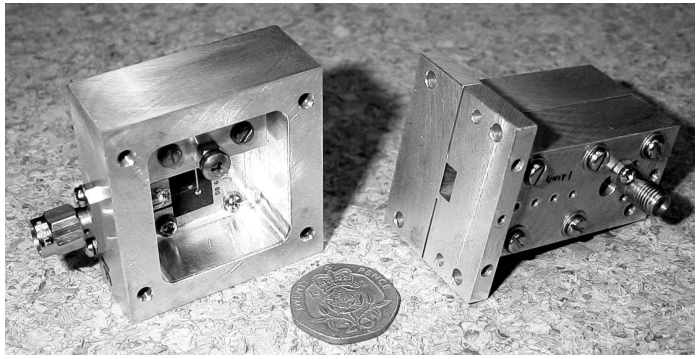
If you were to change the 30 degree flare angle or the larger diameter, that would change the amplitude ratio of the higher mode generation (TM11). If you change the diameter or length of the larger section, that will change the phase relationship between the modes, because they have different cut-off wavelengths and thus different phase velocities in the larger diameter section. The length and diameter of this section is really a phase corrector between the two waveguide modes.

I may be overly-conservative, but here is my opinion. If you are very skilled at 3D modeling of higher-order waveguide mode generation techniques, and if you are skilled at calculating Bessel-Neumann and Hankel Functions, than have at it and please let me know about your results. For the rest of us mere mortals, I recommend that you follow one of W2IMU's two designs exactly and only scale every dimension, proportional to your particular wavelength.

I hope these thoughts are helpful to those who were brave enough to read all of this. Please feel free to correct the errors.

73 and Good UHF/SHF/EHF DX, from Dick, K2R1W

G7MRF's 76GHz modules as described on page three of this month's issue



ACTIVITY NEWS FROM THE WORLD ABOVE 1000MHz

We are a little tight on available space this month so here we go straight into the reports ....and please excuse the abbreviated dialogue in places!

From: Adrian Ball G8PSF [jonball@globalnet.co.uk]
What a wonderful Martlesham event we experienced last weekend! Probably one of the best ever? Just in case some confusion arises over the attribution of my tested dual band feed on Sam`s excellent Test Range, the design originates from a paper read at the 1997 Central States VHF Conference by Al Ward, WB5LUA. Pity we could not have a 5.76GHz test source for the other half of the feed ! However some 33dBi of gain in only a 55cm. offset dish at 10.368GHz is very good. I would pray that the 5.7GHz figure is going to over 30dBi as well. I `ll be forging ahead to try and get it up on the mast early next year and re enter the affray on at least rain scatter activity.

From: Roger Kendall G0UPU [Roger. Kendall@BTInternet.com], IO91AX
I should have been working on Sunday during the last 3cm cumulative but as it was raining I thought that I would try to get on the band to see if I was able to get out better with the rainscatter. My QTH is not an easy one to get out of as I am surrounded by hills with only a narrow path out to the north. Working stations to the East and South is very difficult normally. The rainscatter was quite good and I managed to work G4BRK on ssb for the first time. We are not very far from each other but I have only worked him once before and that was with rainscatter on cw. I was also able to work G3LRP (IO93HO) without using talkback. Although he was my best dx of the day he was very strong with the rain about. There did not seem to be many stations on but perhaps the weather had an effect on this.

I hope to spend the winter improving the mounting of my equipment as my present system is a bit hairy! Its not too bad if I only have my 3cm set operating but if I have my middle band set up as well then I have to do a balancing act on a ladder to get the 3cm set on top of it. One day either the equipment or myself are going to end up in my wife's Alpine greenhouse which is underneath it all and my radio activities will then be restricted!

From: Neil.G4BRK, IO91DP [neil@thewhitings.freeserve.co.uk]
The final 10GHz Cumulative of the year (Oct) was a good one - I worked 17 UK fixed stations (!) plus 2 portables together with F6DKW and PA0WWM .. an excellent turnout, given the WX was awful for /p operation. There was good local rainscatter but it didn't seem to help on the DX.

From: Ted, G3JMY, IO81RM [EDWING3JMY@aol.com]
Not a lot to report on the October 10GHz Cumulative. The morning was slow, with two stations having a lot of trouble with gear and the first hour got us nowhere. I worked 9 stations by lunchtime - mainly very local. G4ZXO/P was the best DX all day. The afternoon brought nothing and I heard Jim at 'ZXO called for an hour without anyone coming back. I shut down and, around 6 pm had a call from Doug, GW3ATM, from home. We made it using the 'phone as talkback since Doug had no 2m. He was firing through the downstairs window and I actually heard him.

From Reg Woolley, G8VHI, Nuneaton
I was able to catch most of the tropo in early Sept and found conditions far better that at G4BRK in fact I found 23cm even better than 2m or 70cm !! From here in IO92FM I worked the following:

12/9/02 DL2NUD J063 59+ , DK2NH JO51 54,
13/9/02 SM6HYG JO58RG 56 (NEW odx!) was only 53 on 70cms b4 qsy!, OZ2OE 59+ JO45, OZ1CTZ 55 JO46, OZ6OL 59+ JO65, SM7FMX 57 JO65, DC4BK 57 JO43
14/9/02 HRD F6APE but did not work him as he was busy with others

My 23cm gear is the same as always, an FT847

driving an old MM transverter and DEM 2 brick PA and MGF1302 preamp in shack. The antenna is a 67el Wimo. Most contacts were either QSYs from 70cm or direct on the band. It's a shame many others in UK don't use 70cm more when the bands are open!

On a more amusing note, my XYL, who has no interest in radio but has an HND in electronics, asked me what was the pile of "Junk" on my shack bench so I told her "23cm" . It maybe so but it seems to work! I hope soon to have a total rebuild on 23cm and put a large signal on the band ... watch this space!

From: Ian, G8IFT [g8ift@sbrs.org.uk]
Please note a number of my email addresses are no longer valid, due to not dialling in to FreeUK/ Free-Online/etc for 120 days! I am now using ADSL l and no longer have a modem! Please can you update your Email list to send to "g8ift@sbrs. org.uk" ?

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BEACON NEWS from: Talbot Andrew [ACTALBOT@mail.dstl.gov.uk]

The repaired GB3SCS on 2320.9 MHz was reinstalled in late October all appears to be OK now. Power output at the equipment rack is 29dBm and the signal received at my standard monitoring site at Lane End Down on Sunday gave a rock-crushing signal. GB3SCK on 24GHz will take a bit longer to get going again as Chris G8BKE is modifying it for 12 Volt operation, so the beacon can survive poweroutages.

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INTERESTING WEBSITES

Chris Bartram [chris@chris-bartram.CO. UK) has placed a slightly extended version of the 'Powerpoint' presentation for his talk, given at the Martlesham Microwave Roundtable, on his web site: **www.blaenffos.org**

The site is very new, so please excuse the rather primitive appearance of the home page. One slide, showing the schematic of a high performance 94MHz Driscoll oscillator, hasn't translated to HTML very well and he will place this on the site as a .PDF in the near future.

From Jonathan Naylor, HB9DRD (G4KLX) [jonathan.naylor@ggaweb.ch] comes news of an interesting site about microwave transverters and things. It's by a company called Makidenki in Japan and *some* of their pages are in English. Unfortunately most of them are in Japanese but specifications and prices are easily understandable. The specifications aren't ultra brilliant but they're usable. The page is at **http://www.makidenki.co.jp/index-en. html** The current exchange rate from Yen to Sterling is 190.

From: Kevin Ravenhill, G1HDQ [hdq@btinternet.com]
I read the article in the October newsletter from John G8ACE ("are we usingthe technology?"), in conjunction with comments from Chris GW4DGU regarding difficulties in attracting people's attention, even with QRO 2m talkback. This seems to be an all-too-common problem nowadays, with signals on, say, 3cm usually being MUCH louder and more reliable than on 2m. This got me thinking.

I would have thought that, by definition, talkback ought to be significantly more reliable/ predictable than the microwave link which you are trying to set up but it does seem to be the other way round nowadays!

So here's a suggestion for future contests and other activity: Since most people seem to carry around the dreaded mobile phone these days, how about publicising (perhaps with suitable safeguards) a list of active Microwavers mobile numbers - along the lines of the current microwavers email list? During contests it could be useful to have telephone "backup" when you know someone is out there and you want to set up a QSO but you just can't hear 'em (or they can't hear you) on 2m. Initial messages could be by voice or text according to preference. With typical current gearload, the inclusion of a mobile phone plus a couple of spare batteries is not exactly going to inconvenience many microwavers.

Please note that I am **not** suggesting that phones should replace radio as a talkback medium (at least for most microwavers - see below!) - simply that they could usefully be used as a routine alternative. It might not work in some areas with poor coverage anyway.

Now I'm going to play Devil's Advocate.... For the likes of me, who doesn't like lugging lots of gear about and are not overly worried at not having decent 2m talkback means they might not work everybody - it could even prove attractive as an alternative. I'm envisaging that not

a backpackable (well, almost) station, with talkback facilities consisting of a small but sensitive 2m SSB receiver plus halo or similar to monitor 2m for activity, with contacts then being set up by phone. Stations calling on 2m could occasionally announce "QRV dog 'n' bone" (QRV Delta Bravo?!) or similar, to let others know they had the capability. Phone numbers would not generally need to be announced over the air if a list was available prior to the event. This system might allow some of the more inaccessible old "wideband" sites to be activated again but this time with the extra punch of narrowband gear.

Something similar to this may well have been suggested before, but if not I would like to know if anyone thinks it has any merit. The idea is still very "rough around the edges" so I'm open to any/all suggestions - I'm also quiteprepared to be shot down in flames! **73, Kevin G1HDQ**

Editor's Comments...

The use of mobile phones has been the subject of discussion at Microwave Committee level recently. The general opinion is that they should be used as a last resort but certainly NOT has a replacement for full talkback and the exchange of information that should normally be reserved for the microwave contact. Those who take part in the Millimetre Bands Contests have been using mobile phones this way as a fallback to announce that they have arrived on site and/or to co-ordinate activities between the various stations out during the day. **What do readers think about Kevin's idea of a list of mobile phone numbers?**

All-band Microwave Contest - 11/Aug/2002
Adjudicated scores

Individual Band Tables

1.3GHz	Best DX	Located	Distance	QSOs	Score
G4BRK	PA5DD	JO22IC	443km	12	2296
G3ZME/P	G4EAT	JO01HR	235km	7	678
G3PHO/P	G4BRK	IO91DP	158km	7	665
G4LDR	G4ALY	IO70VL	447km	4	447
G0UPU	G3PHO/P	IO93FB	124km	5	338
G3YKI	G3PHO/P	IO93FB	104km	4	248

2.3GHz	Best DX	Located	Distance	QSOs	Score
G4BRK	GD4GNH	IO74QD	340km	3	488
G4LDR	G8JVM	IO82SP	192km	2	192
G3ZME/P	G0UPU	IO91AX	70km	2	91
G0UPU	G3ZME/P	IO82QL	72km	1	72

3.4GHz	Best DX	Located	Distance	QSOs	Score
G3YKI	G4BRK	IO91DP	57km	2	76
G4BRK	G3YKI	IO92BD	57km	1	57
G4LDR	G1JRU	IO90HU	33km	1	33
G0UPU	G3YKI	IO92BD	19km	1	19

5.7GHz	Best DX	Located	Distance	QSOs	Score
G3PHO/P	F1PYR/P	JN09LN	426km	7	1487
G4BRK	F1PYR/P	JN09LN	298km	3	675
G4LDR	F1GHB/P	IN88IN	540km	3	540
G0UPU	G3PHO/P	IO93FB	124km	1	124

10GHz	Best DX	Located	Distance	QSOs	Score
G4BRK	PA0WWM	JO22FE	427km	15	2895
G3PHO/P	F1PYR/P	JN09LN	426km	16	2618
G3ZME/P	F1GHB/P	IN88IN	438km	15	1915
G4LDR	F6DKW	JN18CS	352km	8	1352
G3JMY	G0HNW/P	IO85VE	408km	7	921
G3YKI	G3PHO/P	IO93FB	104km	4	248
G0UPU	G3PHO/P	IO93FB	124km	3	215

24GHz	Best DX	Located	Distance	QSOs	Score
G3PHO/P	G3ZME/P	IO82QL	97km	1	97
G3ZME/P	G3PHO/P	IO93FB	97km	1	97

Overall results table

	1.3	2.3	3.4	5.7	10	24	Total
G4BRK	1000	1000	750	454	1000	0	4204
G3PHO/P	290	0	0	1000	904	1000	3194
G3ZME/P	295	186	0	0	661	1000	2142
G4LDR	195	393	434	363	467	0	1852
G3YKI	108	0	1000	0	86	0	1194
G0UPU	147	148	250	83	74	0	702
G3JMY	0	0	0	0	318	0	318

Entrants report that conditions were very poor for most of the contest, and many paths which normally work refused to do so. The weather was overcast with drizzle and/or showers, depending upon where you were. As a result, activity was not that high, and only 1 QSO was reported on 24GHz, and none on higher bands.

The overall winner was the Neil G4BRK, operating from home. Neil entered scores for 5 out of the six bands, and was band leader on 3 bands. Despite trying very hard, no QSOs were made on 24GHz.

Runner-up was Peter G3PHO, operating from Alport Height, who was band leader on 2 bands, and a close second on another. Peter comments that there was welcome support for 10 and 5.7GHz by several French/Dutch.

73 from Steve, G4KNZ

That's it for this month except for a "whole bunch" of contest results. Here they are, courtesy of Steve Davies, G4KNZ, the Contest Adjudicator. Next year's contest programme and rules will be published in the next issue of the Newsletter, due out in mid January 2003. Meanwhile you can find them at the

World Above 1000MHz website:
www.g3pho.free-online.co.uk/

A HAPPY CHRISTMAS TO ALL OUR READERS

All-band Microwave Contest - 06/Oct/2002
Adjudicated scores

Individual Band Tables

1.3GHz	Best DX	Located	Distance	QSOs	Score
G3OHM/P (SBRS)	DK0HN	JO31PP	683km	17	3769
G3PHO/P	G4LDR	IO91EC	247km	11	1470
G4BRK	PA0BAT	JO31FX	563km	3	810
G4LDR	G3PHO/P	IO93EH	247km	5	702
G0UPU	G3OHM/P	IO82QL	72km	3	138

2.3GHz	Best DX	Located	Distance	QSOs	Score
G3OHM/P (SBRS)	PA6NL	JO21BX	463km	5	1083
G4LDR	G3OHM/P	IO82QL	168km	6	520
G0UPU	G3OHM/P	IO82QL	72km	1	72
G4BRK	G4LDR	IO91EC	61km	1	61

3.4GHz	Best DX	Located	Distance	QSOs	Score
G8IFT/P (SBRS)	PA6NL	JO21BX	463km	6	1087
G4LDR	G3XDY	JO02OB	223km	5	570
G4BRK	G3XDY	JO02OB	206km	3	324
G0UPU	G8IFT/P	IO82QL	72km	2	91

5.7GHz	Best DX	Located	Distance	QSOs	Score
G8IFT/P (SBRS)	PA6NL	JO21BX	463km	6	1092
G3PHO/P	G4LDR	IO91EC	247km	6	976
G4LDR	G3PHO/P	IO93EH	247km	5	777
G4BRK	G3LRP	IO93HO	219km	4	672
G0UPU	G3PHO/P	IO93EH	150km	3	241

10GHz	Best DX	Located	Distance	QSOs	Score
G3PHO/P	F6DKW	JN18CS	572km	16	3197
GW3UKV/P	G3XDY	JO02OB	297km	15	2147
G4MAP/P (SBRS)	PA6NL	JO21BX	463km	12	1890
G4LDR	G3PHO/P	IO93EH	247km	12	1318
G4BRK	G3LRP	IO93HO	219km	10	1141
G0UPU	G3LRP	IO93HO	185km	5	506

24GHz	Best DX	Located	Distance	QSOs	Score
GW3UKV/P	G4BRK	IO91DP	103km	2	173
G4BRK	GW3UKV/P	IO81KW	103km	1	103
G8IFT/P (SBRS)	GW3UKV/P	IO81KW	69km	1	69
G4LDR	G8ACE/P	IO91JA	31km	2	47
G3PHO/P	G3LRP	IO93HO	35km	1	35

47GHz	Best DX	Located	Distance	QSOs	Score
GW3UKV/P	G8IFT/P	IO82QL	69km	1	35
G8IFT/P (SBRS)	GW3UKV/P	IO81KW	69km	1	35

Overall results table

	1.3	2.3	3.4	5.7	10	24	47	Total
SBRS	1000	1000	1000	1000	591	399	1000	5990
GW3UKV/P	0	0	0	0	672	1000	1000	2672
G4LDR	186	480	524	712	412	272	0	2586
G3PHO/P	390	0	0	894	1000	202	0	2486
G4BRK	215	56	298	615	357	595	0	2136
G0UPU	37	66	84	221	158	0	0	566

Conditions were described as average to poor, and activity in the UK was fairly low. Peter G3PHO commented that there were only 22 UK stations QRV on 10GHz but thanks mainland European stations for their support. Only six entries were received; however, it was encouraging that five out of these six included 24GHz, and two also included 47GHz.
Congratulations to the **overall winner, the South Birmingham RS, operating as G8IFT/P, G4MAP/P and G3OHM/P.** The group were the only entrants operational on all bands from 1.3 to 47GHz, and were band leaders on 5 of the 7 bands. An impressive list of equipment was taken out for all bands. Operators were Andy G4MAP, Roy G8ACR, Bob G8GDZ, Ian G8IFT, Steve G8KOS and Mark M0CZE.
Four stations were vying for second place, with fairly close scores, and in the end, the honour went to GW3UKV/P, who was band leader on 24GHz and on 47GHz (jointly with SBRS).
Thanks to everyone who took part, also thanks to G3XDY for the check log.
The event was timed to coincide with the IARU event on the same weekend.
Opinion varied as to the merits of this, with some operators entering both the
24 hour event and this contest, and as a result, having to work some stations
again (that they had worked on the Saturday) for them to count in this event.
NB: Some changes are planned to the calendar events to be run in 2003.
73 from Steve, G4KNZ

Activity for this event was rather poor, a number of operators being away at the Weinheim convention! From the two logs received, a total of five stations were logged active on 24GHz, and just two on 47GHz.
Neil G4BRK leads on 24GHz, and he was very pleased to get a one-way QSO with G1JRU over a very obstructed 90km path. **Only one entry, from G8IFT/P, was received for 47GHz**.

24/47GHz Microwave Contest - 08/Sep/2002
Adjudicated scores

Individual Band Tables

24GHz	Best DX	Located	Distance	QSOs	Score
G4BRK	G3UKV/P	IO82QL	112km	3	213
G8IFT/P	G7MRF/P	IO93AD	87km	2	143

47GHz	Best DX	Located	Distance	QSOs	Score
G8IFT/P	G7MRF/P	IO93AD	87km	1	43

10GHz CUMULATIVE RESULTS 2002

A total of 15 entries were received for the 2002 10GHz cumulatives - 10 in the open section and 5 in the restricted section. This compares to a total of 13 entries in 2001.
The results table appears on the following page.

In the Open section, congratulations to **G4ZXO/P**, operating from Ditchling Beacon, who narrowly beat G3PHO/P, due in part to managing the highest multiplier, of 18. G4ZXO/P was running a 10W PA into a 75cm dish, mounted 5m above ground level. Talkback on 2m was 150W into a 7 element yagi. The best DX was HB9AMH/P (JN37) at 675km, in the July session.

In the Restricted section (max 10GHz power of 1W), congratulations **to GW3ATM/P**, who operated mostly from The Blorenge. GW3ATM/P was running a 1W PA into a 70cm offset dish mounted 2m above ground. Best DX was G4EAT (JO01) at 252km.

The May session saw the least activity, due to poor weather, with heavy showers and strong winds, although there were still as many stations QRV as most other months. Activity in October was also not very good. The remaining sessions were all about equal in terms of QSOs made and points scored. Typically, there are between 30 and 40 stations active.

Peter G3PHO comments that the season was characterised by poor microwave (and VHF) conditions on the whole. A few good 500km plus contacts were made, but there were no particularly good sessions for DX.

As usual, not everyone read the rules regarding scoring and multipliers and, where necessary, the scores were corrected. Some people did not state whether they wished to enter the Open or Restricted session - in which case, they were entered according to the output power they declared they were using (but if in doubt, in the Open section). One or two stations were also a little careless in their logging, with a few incorrect reports, serial numbers and even callsigns noticed; this time, the errors did not affect the overall results.

Thanks to all who took part, and especially to those who sent in an entry, even if only active in a few of the sessions. Thanks also to the many French, Dutch and Belgian stations who come on regularly during the cumulatives - they are much appreciated.
The calendar and rules for 2003 are about to be published. The main change for 2003 is that there will be concurrent cumulatives on both 10GHz and 5.7GHz on each of the six days (May, through to October) - scoring for each will be separate.

73 from G4KNZ November 2002.

RSGB 10GHz Cumulatives 2002

Open Section

		26-May	23-Jun	28-Jul	25-Aug	22-Sep	20-Oct	**Points**	Mult	**Total**
1	G4ZXO/P	0	4401	5250	5002	4425	3667	**19078**	18	**343,404**
2	G3PHO/P	4084	6285	5404	6074	4341	0	**22104**	15	**331,560**
3	G4LDR	1220	1871	2336	2731	2375	315	**9313**	16	**149,008**
4	G3JMY	1626	2077	2361	1594	2473	823	**8537**	13	**110,981**
5	G4NNS	2498	1594	1672	1562	1923	2065	**8158**	13	**106,054**
6	G3LRP	1635	1799	1882	2105	2511	3298	**9796**	10	**97,960**
7	G4ALY(/P)	800	2490	1738	3242	2509	2137	**10378**	9	**93,402**
8	G4BRK	0	3351	0	0	0	2650	**6001**	12	**72,012**
9	G0UPU	648	347	557	269	0	293	**1845**	6	**11,070**
10	G8GTZ/P	411	0	0	0	0	0	**411**	4	**1,644**

Restricted Section

		26-May	23-Jun	28-Jul	25-Aug	22-Sep	20-Oct	**Points**	Mult	**Total**
1	GW3ATM/P	2205	2296	2685	0	2272	203	**9458**	10	**94,580**
2	G8BKE/P	0	1843	1639	0	1264	0	**4746**	11	**52,206**
3	G1MPW/P	0	694	744	0	1142	0	**2580**	9	**23,220**
4	G0RRJ	695	694	0	0	0	1139	**2528**	8	**20,224**
5	G6KIE/P	0	491	536	0	1167	0	**2194**	9	**19,746**