

MICROWAVE
WORKSHOP
Telford
3rd March 2007



UK MICROWAVE GROUP

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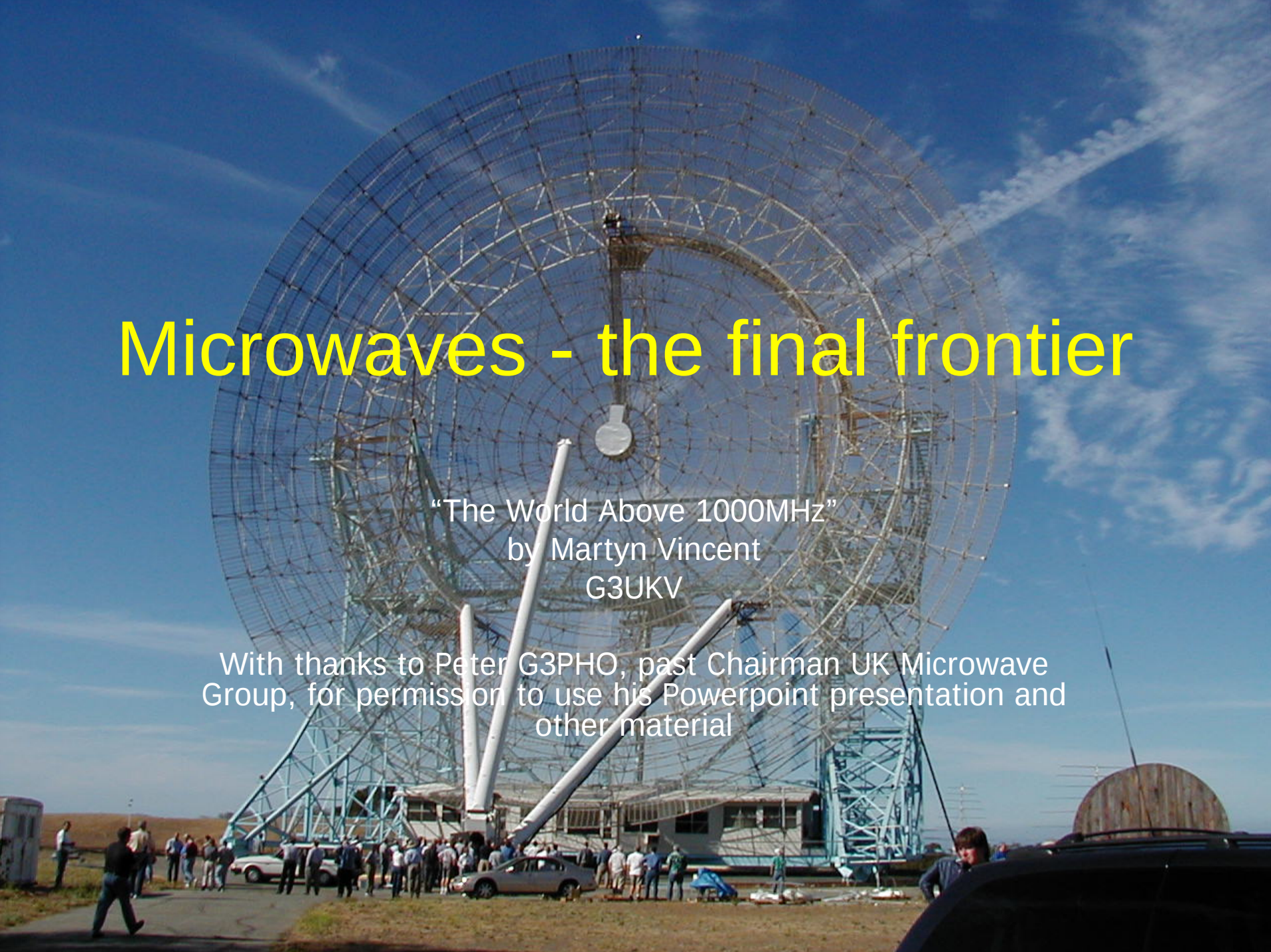
Programme

- 1000-1030 ARRIVAL – Coffee & Tea available
- 1030-1040 Welcome & Domestics: Richard M1RKH
- 1040-1125: Microwaves Introduction: Martyn G3UKV
- Grab a cup of tea
- 1130-1215 Antenna Workshop: Mike G4NKC
- 1215-1300 Wideband FM & ATV: Dave G8VZT
- 1245-1330 Working Lunch
- 1330-1415 Surplus Gear – identification & use: Mike G3PFR
- Grab a cup of tea
- 1430-1515 Converting ex-commercial gear 6 or 9cm: Richard G8JVM
- 1515-1600 Simple Test Gear – workshop
- 1600-1630 Q & A
- Closing Remarks: Richard M1RKH

Microwaves - the final frontier

"The World Above 1000MHz"
by Martyn Vincent
G3UKV

With thanks to Peter G3PHO, past Chairman UK Microwave
Group, for permission to use his Powerpoint presentation and
other material





What use are microwaves?

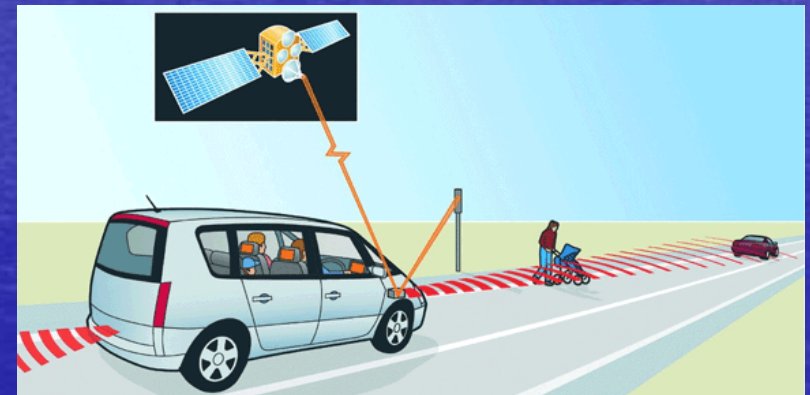
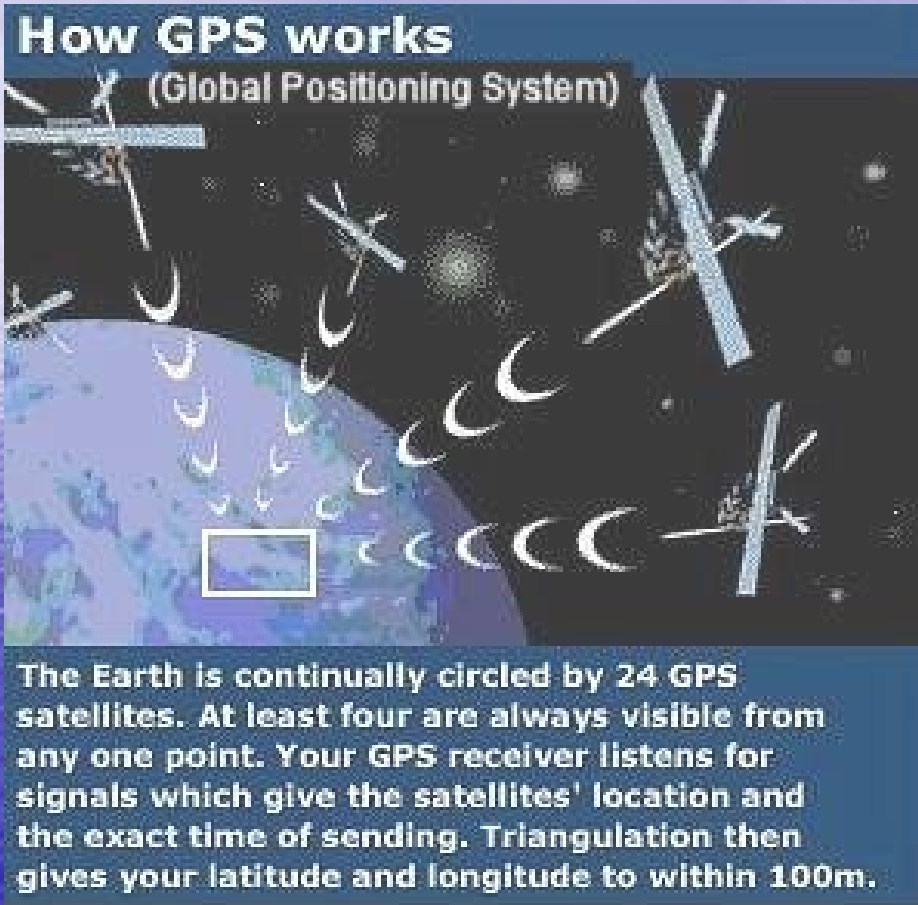
... or “Can’t cook, won’t cook!”

Every home
has one !



Every Teenager
has one !

Knowing where you are ... via microwaves



anti-collision radar & GPS

Ladies can always try this!

A Whole New World of Styling Possibilities...
For Less Than the Cost of One Trip to the Salon

Microwaves Heat Cap

\$ 49⁹⁵
+4.95 s/h *

Order On-Line

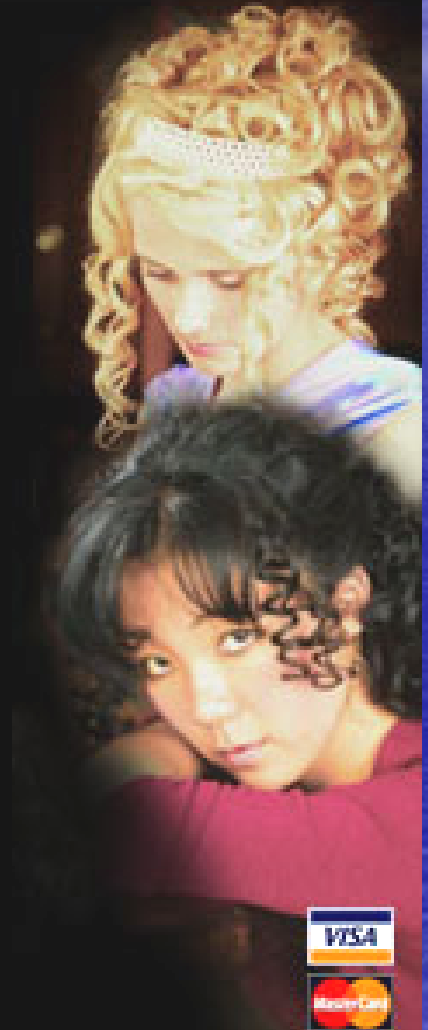
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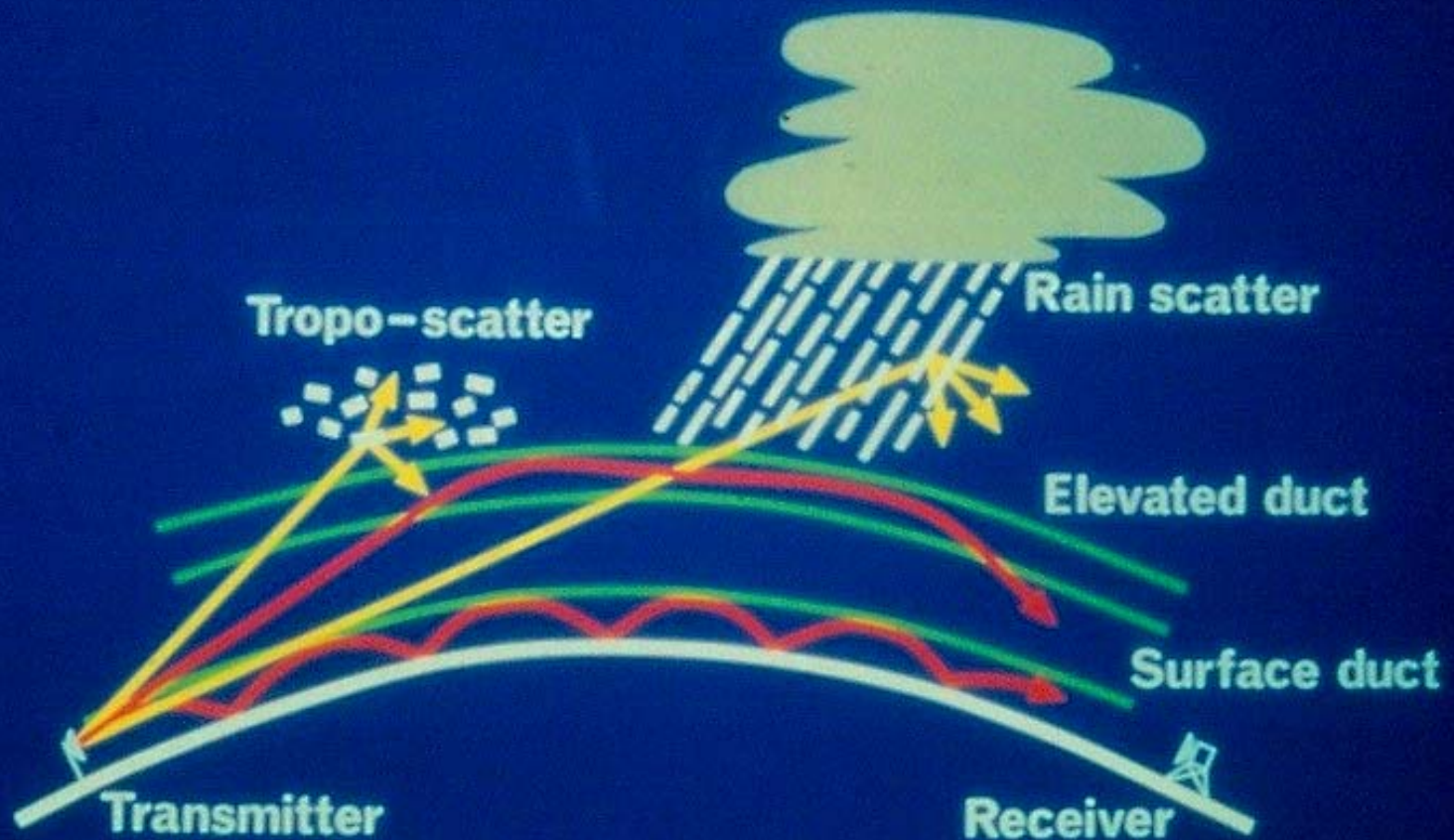


What are microwaves?

- Frequencies above 1000MHz (1GHz)
- Very short wavelengths ... less than 30cm
- They are 'pioneer' bands where you can become a 'real radio amateur' once again!

Terrestrial microwave propagation

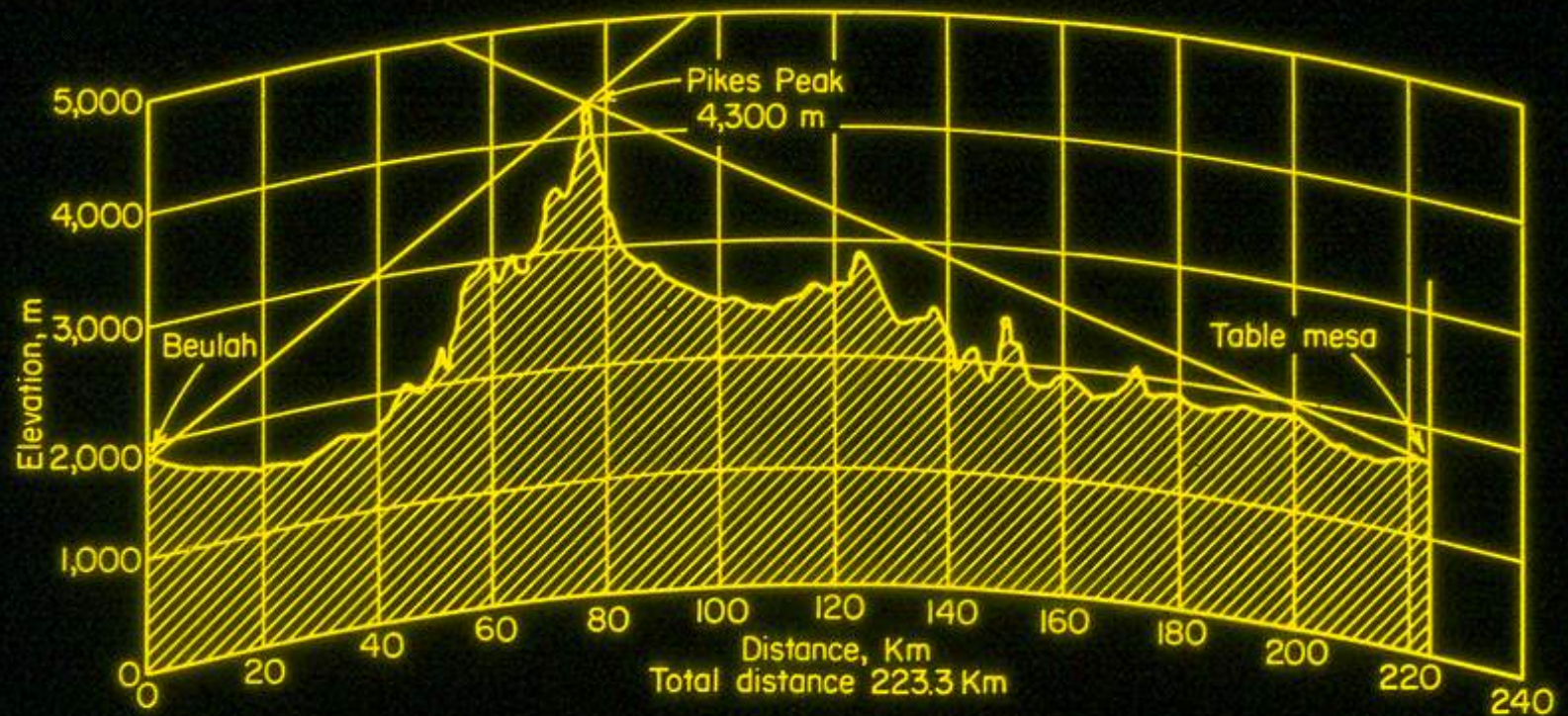
TRANS-HORIZON PROPAGATION MECHANISMS IN THE ATMOSPHERE





... and we
mustn't forget
aircraft reflections

Knife Edge Diffraction





Or you always use the Moon!

Each amateur microwave band is very much larger than any HF band

- 10GHz has more spectrum allocation than all the amateur shortwave bands put together!
- These bands are under a great threat from commercial interests!
- If we don't use them we will lose them!

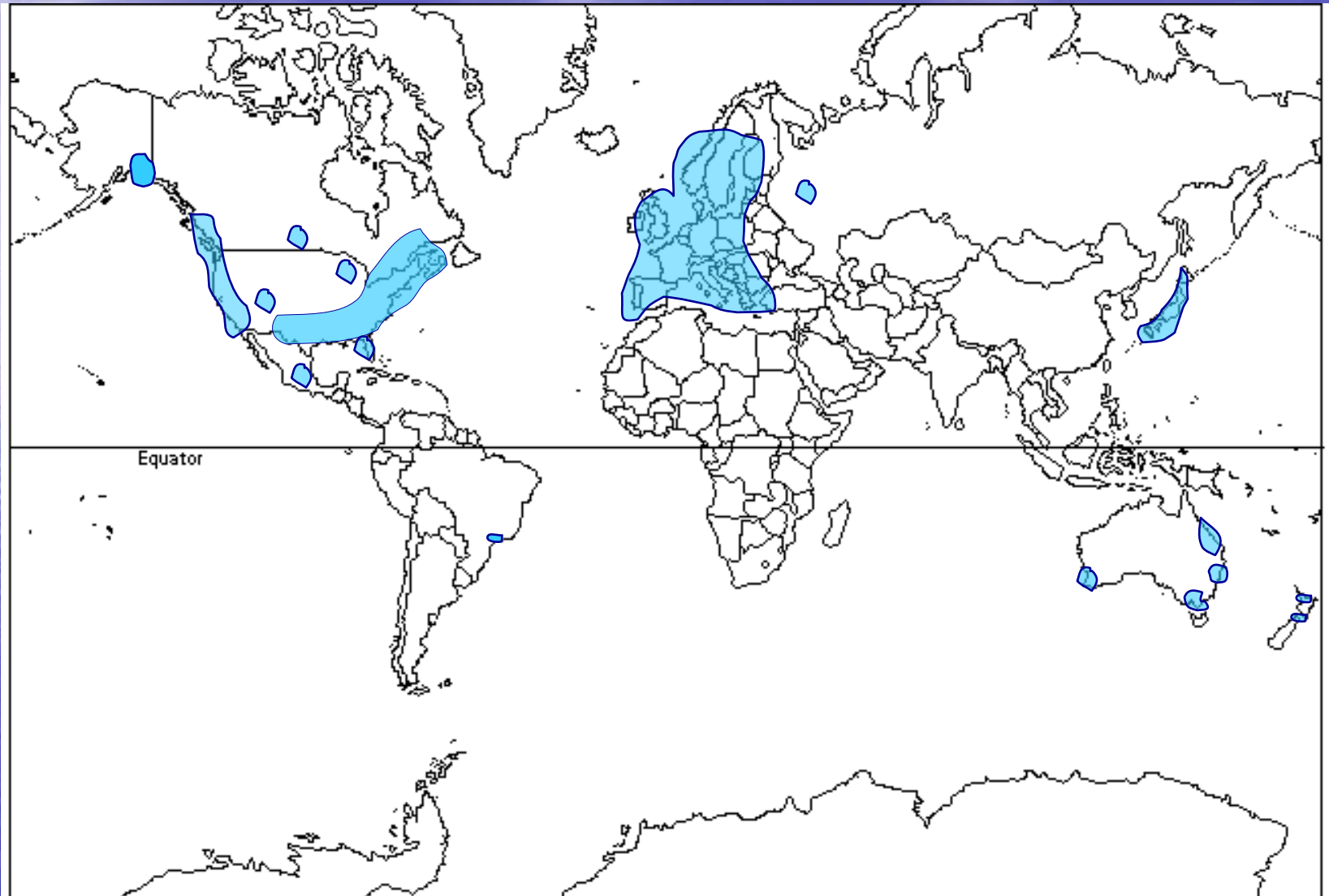
UK Microwave Bands 2007

23cm	1240.0 - 1325MHz	NB 1296 - 1298MHz
13cm	2310.0 - 2450MHz	NB 2320 - 2322MHz
9cm	3400.0 - 3475MHz	NB 3400 – 3402MHz
6cm	5650.0 - 5850MHz	NB 5760 - 5762MHz
3cm	10.000 - 10.125GHz	ATV and other wb modes
3cm	10.225 - 10.500GHz	NB 10.368GHz
12mm	24.000 - 24.250GHz	NB 24.048GHz
6mm	47.000 - 47.200GHz	NB 48.088GHz
4mm	75.500 - 81.000GHz	NB 77.500GHz (?)
2.5mm	122.250 - 123.000GHz	
2.2mm	134.000 - 141.000GHz	
1.2mm	241.000 - 250.000GHz	

UK MICROWAVE BAND OCCUPANCY 2007

23cm:	100-200 operators
13cm:	less than 100
9cm:	15 – 20
6cm:	15 – 20
3cm:	c. 100
24GHz:	35
47GHz:	10
76GHz:	6

Microwavers can be found around the world but cluster in the more technically advanced countries



Mercator Projection, Scale 1:170,000,000

Just look what you can do on the microwave bands !

- Talk to folk ... just like other bands!
- Experiment ... especially with high gain antennas
- Make your own equipment
- Amateur TV
- Data links
- Amateur Satellites
- Moonbounce .. EME
- Enter contests
- Chase DX
- Make some really good friends



The world 10GHz EME record is held by
a German and a New Zealand station
... over 11,000 miles earth distance
but over 500,000 miles via the Moon!

DID YOU KNOW THAT

- England to Australia has been worked via amateur 10GHz EME operators?
- USA and Canadian stations have worked into Russia on 47GHz EME?
- Some amateur microwave operators run over 300 watts output and have dishes in excess of 10 metres diameter?
- The P3 series amateur radio satellites use microwave frequencies

How did amateur microwaves come about?

Our heritage

AMATEUR MICROWAVE HISTORY TIME LINE

1894 -96

Jagadish Chadra Bose

experimented on 60GHz over 1 mile DX using primitive semiconductors!

Bose was the 'Father of Microwaves'



1946

First reported amateur microwave contacts:

W1LZV/2 worked W2JN over 2 miles on 10GHz

W1NVL/2 worked W9SAD/2 on 21.9GHz (800 feet !)

World 10GHz record set at 7.6 miles by W4HPJ/4 and W6IFE/3

1949

FIRST UK MICROWAVE CONTACTS

G3BAK (became VK5ZO) worked G3LZ over 27 miles (new world 10GHz record!)

1950

WORLD 23cm RECORD SET BY UK STATIONS

October 1st: G3QC and G8DD worked over

75 miles from Worcester Beacon to Merryton Low

1950s-70s

Most microwave work done in USA and UK with klystrons for TX and diodes for RX. Other microwave bands opened by amateurs (eg 3.4GHz)

1960

10GHz WORLD RECORD EXTENDED TO 426km

W7JIP/7 worked W7LHL/7 .

Record stood until 1976

10,000 Mc. Record Broken

On July 31 W7JIP/7 operating on top of Mary's Peak near Corvallis, Oregon, and W7LHL/7 on Green Mt. near Granite Falls, Washington, made a two-way contact on 10,000 Mc. at 0620 PST using A2. At 0624 PST they went to A3 and kept in contact until 0900 PST. This distance is $265\frac{1}{2}$ miles. Ernie was assisted by W7PVZ, W7TWX, K7IPI, and his ten-year-old son, Jimmy.



**News
clippings,
from QST, of
the 1960
World 10GHz
record**

Ernest Manly, W7LHL, operating the northern end of the 265-mile 10,000-Mc. circuit. The site was Green Mountain, Washington. W7JIP was on Marys Peak, Oregon, for the new record.

Mid 1970s

GUNN DIODES APPEARED ON AMATEUR MARKET

Revolutionised 10GHz amateur radio → light weight, portable gear running on 12V batteries.

1975

First G to PA 10GHz contact: G8APP/P to PA0KKZ

1976

UK 10GHz RECORD SET AT 245km

Cairnsmore of Carsphairn to Snowdon path worked by GM3OXX/P and GW4BRS/P. (Later repeated by G3MWN, G3PHO and G1BHQ)

1976

10GHz WORLD RECORD BROKEN BY UK STATIONS

GM3OXX/P worked GW4BRS/P over a non-line of site path between Pendeen Sands (Cornwall) and Portpatrick in S.W. Scotland 521km

End of 1976

12 countries worked by G stations on 10GHz

Late 1970s

Early NARROWBAND (crystal control) experiments made by G3BNL and G3AAZ. Set up UK records on many of the microwave bands. NON-LINE OF SIGHT paths now became routine with this gear.

Early 1980s

G3JVL developed the JVL narrowband transverter

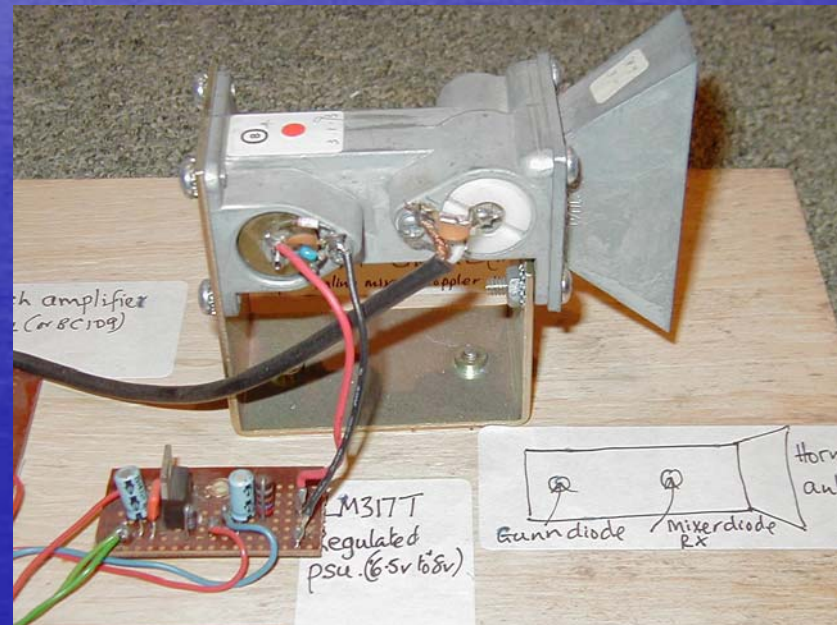
Although very low power (less than 1mW output) it gave amateurs the chance to get on narrowband for the first time, especially on 5.7GHz and 10GHz. Much Gunn diode work was still being done on 10GHz

Mid 1980s

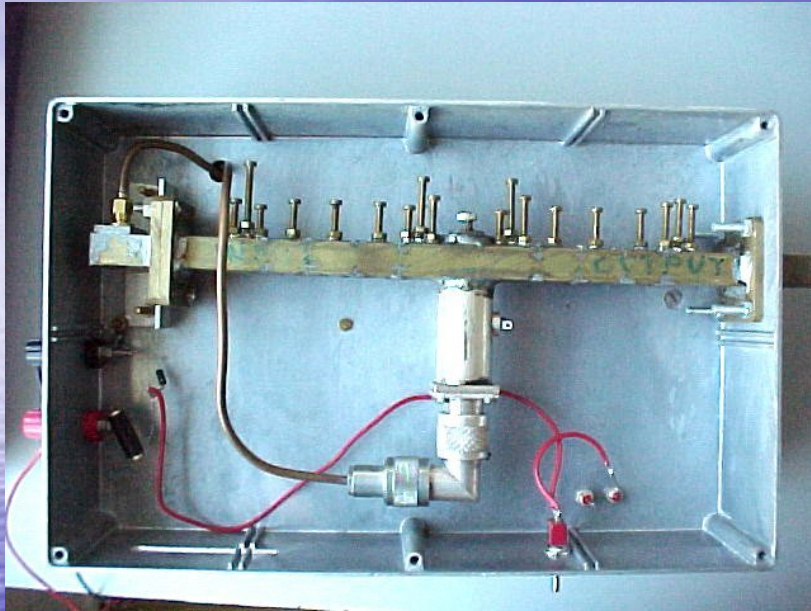
GaAsFETs ARRIVE ON AMATEUR MARKET

Led to first 10GHz 'Black Box' commercial transverter - the German SSB Products system.

It was all klystrons in the 1960s-70s
and then Gunn diodes in the 70s-80s



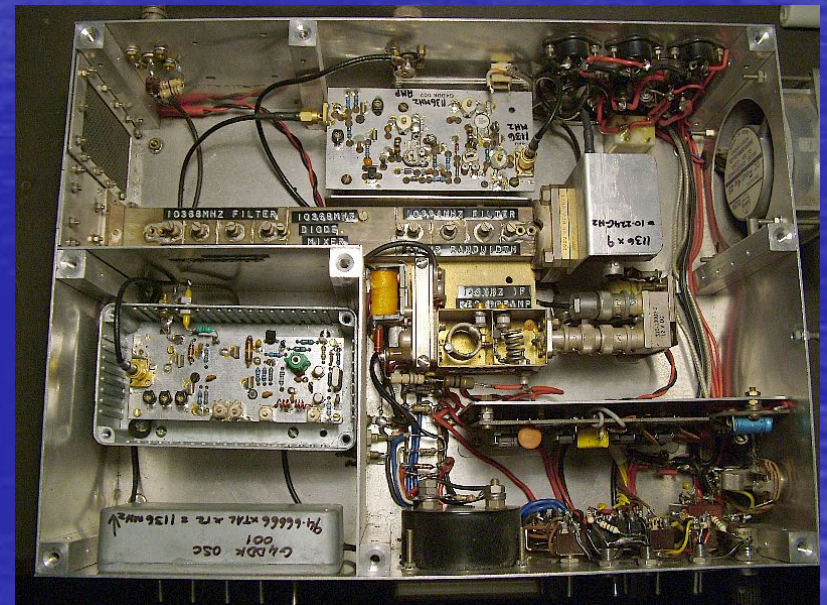
Then along came narrowband ...

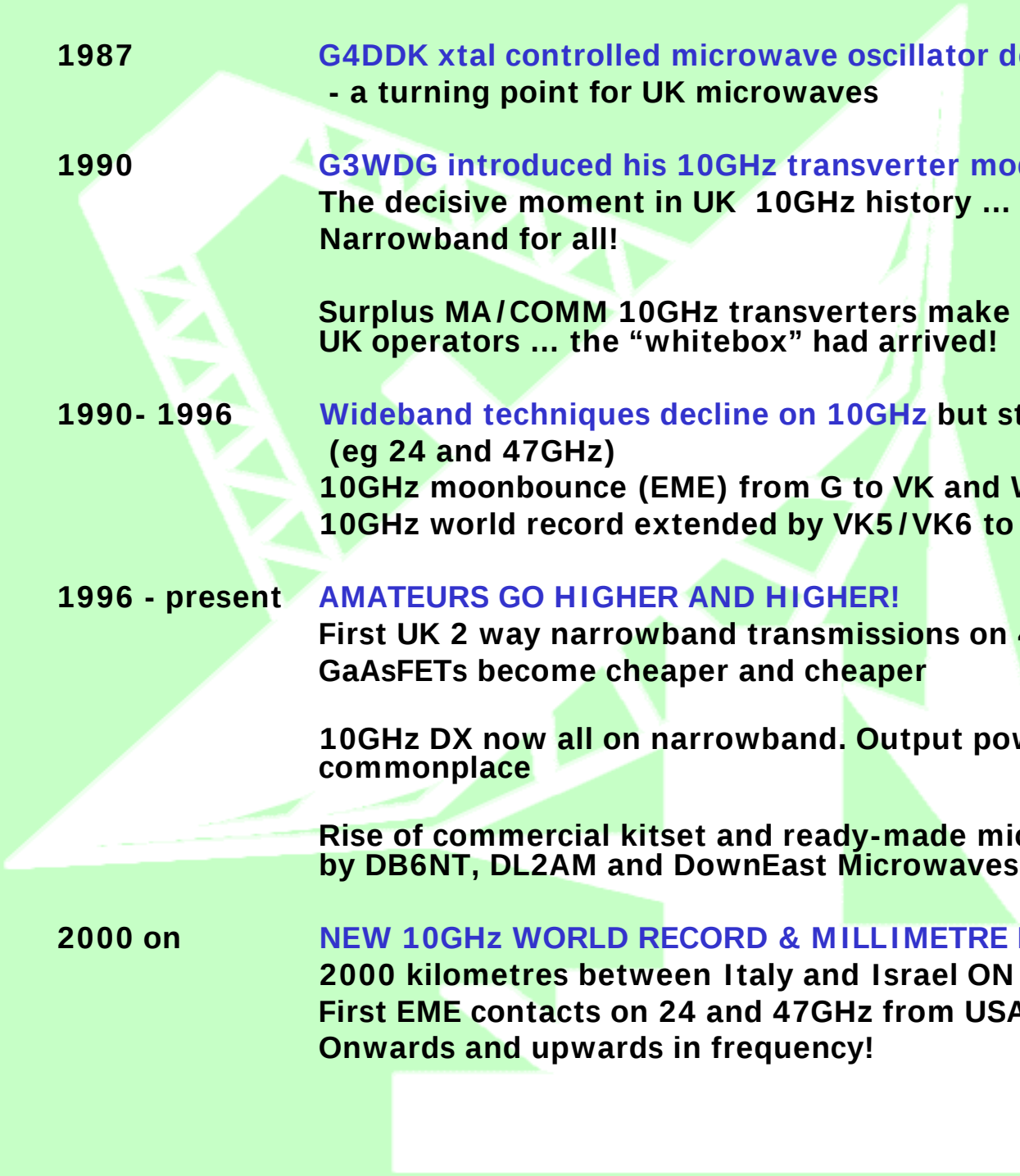


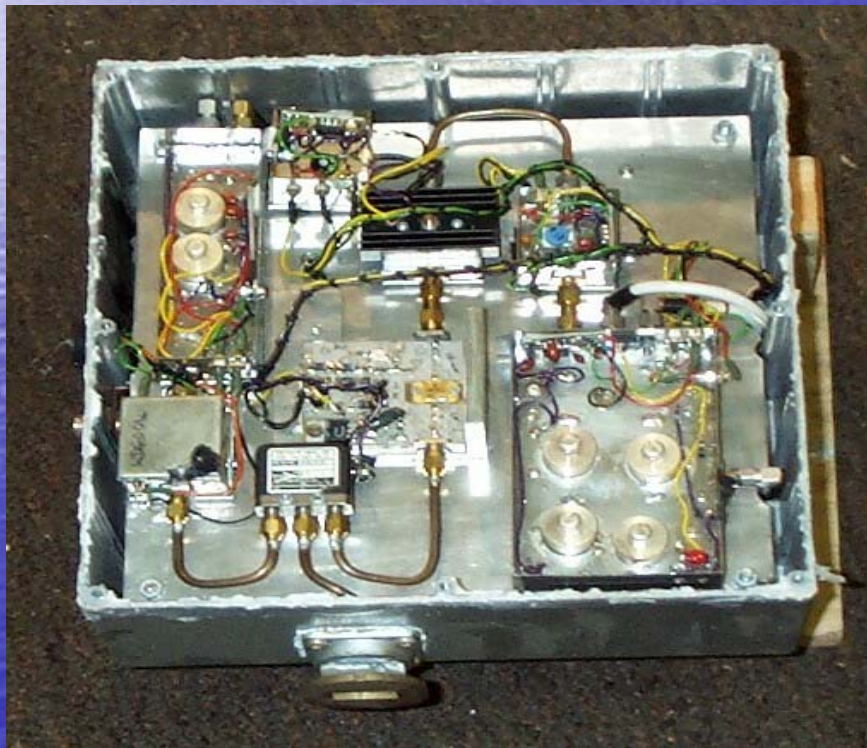
Above: by OH2AUE

- In the 1980s G3JVL developed a 10GHz cw/ssb transverter in waveguide
- Bulky and low power (0.5mW) ... 8dB NF

Right: VK2ALU's transverter



- 
- 1987** **G4DDK xtal controlled microwave oscillator design published**
- a turning point for UK microwaves
- 1990** **G3WDG introduced his 10GHz transverter modules @ kits**
The decisive moment in UK 10GHz history ...
Narrowband for all!
- Surplus MA/COMM 10GHz transverters make easy route to narrowband for UK operators ... the “whitebox” had arrived!
- 1990- 1996** **Wideband techniques decline on 10GHz** but still important above 10GHz
(eg 24 and 47GHz)
10GHz moonbounce (EME) from G to VK and W to VK
10GHz world record extended by VK5/VK6 to 1912 kilometres
- 1996 - present** **AMATEURS GO HIGHER AND HIGHER!**
First UK 2 way narrowband transmissions on 47, 75 and 142GHz.
GaAsFETs become cheaper and cheaper
- 10GHz DX now all on narrowband. Output powers up ... several watts commonplace
- Rise of commercial kitset and ready-made microwave transverters supplied by DB6NT, DL2AM and DownEast Microwaves
- 2000 on** **NEW 10GHz WORLD RECORD & MILLIMETRE BAND EME**
2000 kilometres between Italy and Israel ON 10GHz
First EME contacts on 24 and 47GHz from USA to Russia
Onwards and upwards in frequency!



In the early 1990s, Charlie Suckling, G3WDG and Sam Jewell, G4DDK developed modules based on PCB circuitry. These were made available in kit form and revolutionised UK 10GHz operating!

But aren't all microwave contacts line-of sight?

- Certainly not!
- This was so in the early days but not today with higher power levels and narrowband (ssb/cw) equipment
- BUT you can still have a lot of fun with simple wideband FM gear over line-of-sight paths as shown by the following photos

BACK PACK PORTABLE

- Microwaving at its simplest
- Link with Summits on the Air
- Get fit as you do amateur microwaves !

BACK PACK PORTABLE IN 1973





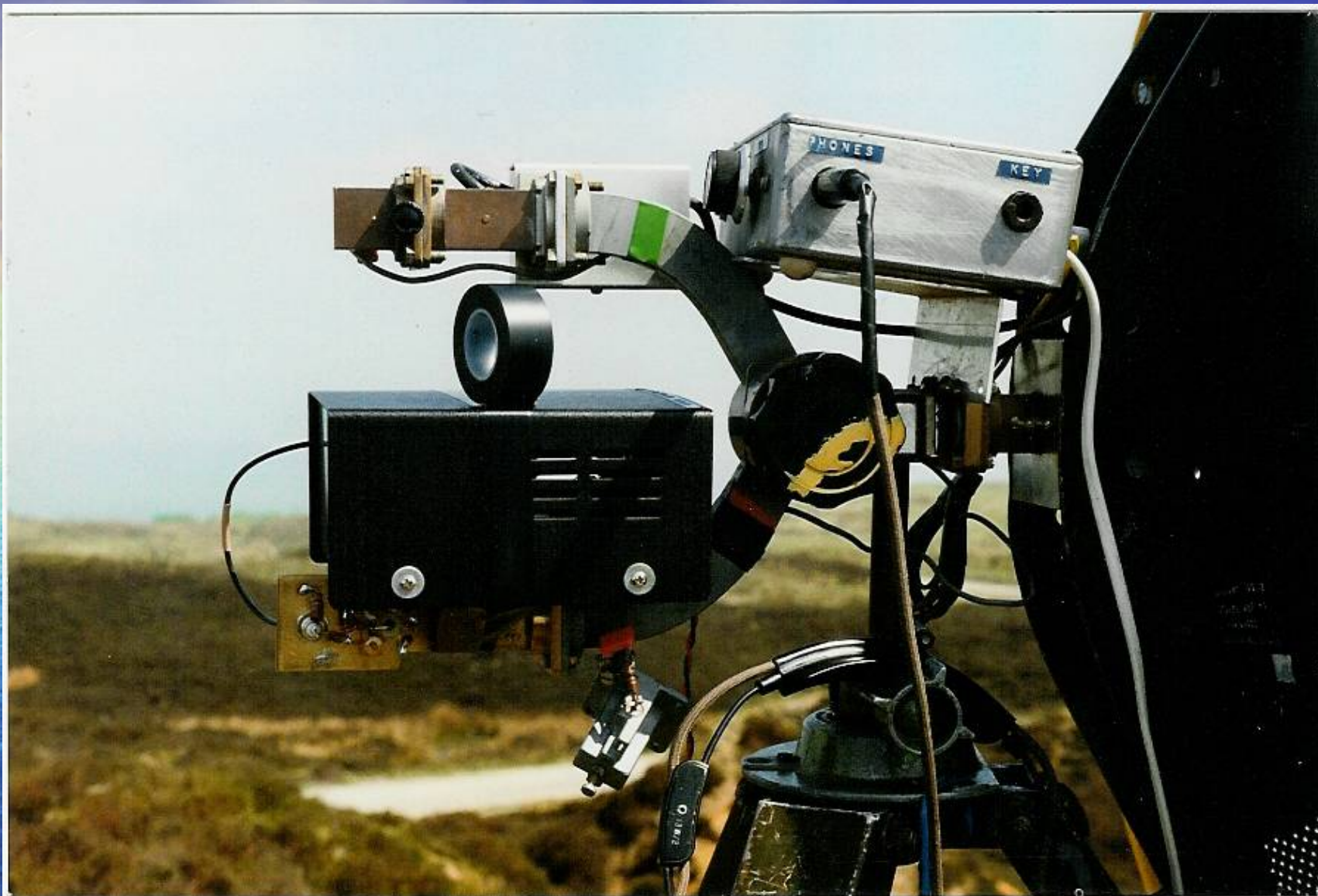
The complete station, 10GHz Gunn transceiver and 144MHz talkback ssb transceiver, 24" dish and support mast all fitted in a rucksack and was carried up 3000 foot mountains!

**G3PHO/P in the mid
1980s**





1986: GM3PHO/P and GM1BHQ/P on the Cairnsmore of Carsphairn, Galloway, SW Scotland in contact with Eric, **GW3MWN/P** on Snowdon summit. Both stations were using 10mW Gunn transceivers on 10GHz wideband FM over the **245km** Line-of-Sight UK DX record distance.



Switchable Wideband (Gunn oscillator with Birkett 300mW device) and Narrow band (G4DDK 004 board + waveguide mounted diode multiplier/filter: 50mW?)
G3UKV/P c. 1990.

G4FPV/P using solar powered gear



How far can you get with microwaves these days?

- The next slide shows the latest UK distance records, at the end of 2006, on all microwave bands up to 145GHz

UK Microwave Terrestrial Records

• 1.3GHz	2617Km
• 2.3GHz	1083Km
• 3.4GHz	980Km
• 5.7GHz	1244Km
• 10GHz	1347Km
• 24GHz	391Km
• 47GHz	203Km
• 76GHz	79.6km
• 134GHz	17.7km
• 145GHz	1.29km
• Light (red)	76km

WAYS INTO AMATEUR MICROWAVES

BUY COMMERCIAL GEAR

BUILD YOUR OWN GEAR

MODIFY SURPLUS

BORROW EQUIPMENT





1.3GHz (23cm) is perhaps the easiest microwave band on which to make a start. There's lots of ready-made equipment for this band and you can use coax-fed yagi beams instead of dishes.

This is an old Microwave Modules 23cm transverter. It gives 1 watt out and transverts down to 144MHz. You can find them at rallies for as little as £50

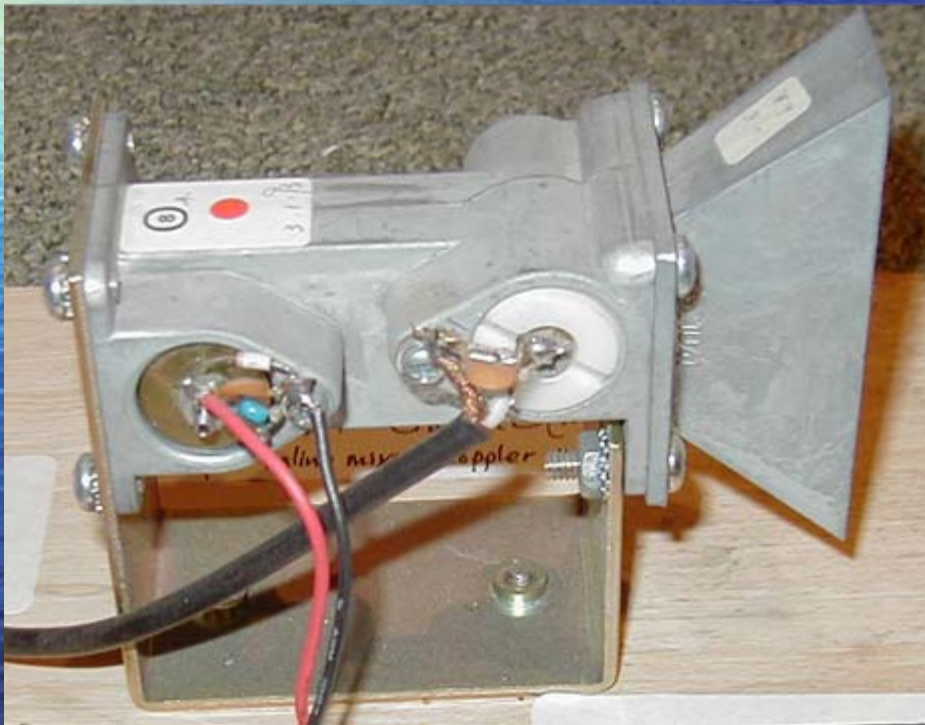
It's not state-of-the-art but it will get you going on microwaves!



SIMPLE MICROWAVE EQUIPMENT

To be described in other presentations
later today

Based on surplus Gunn or DRO doppler modules or ex satellite TV parts





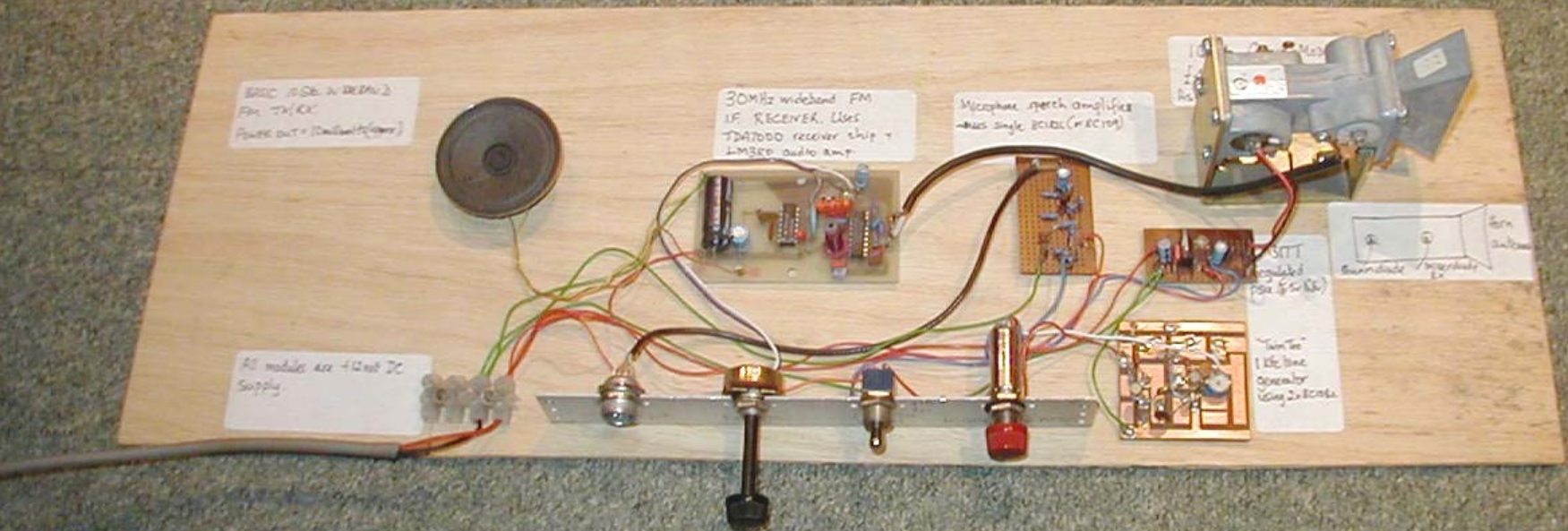
Dishes from
old domestic
Sat TV
installations

G3ZME/P The Wrekin VHF NFD



- Just timber and chicken wire
- for 1296 MHz

A “Breadboard” Wideband FM Transceiver for 10GHz



You'll also need 2m ssb gear
for talkback liaison

FT817



Low power
backpackable
2m ssb talkback
transceivers

FT-290
2m ALL MODE TRANSCEIVER



IC202S



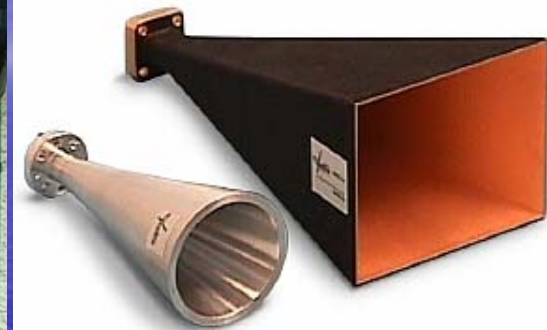
Antennas

- 1296MHz and 2.3GHz – yagi or dish
- 3.4GHz up – dishes or horns

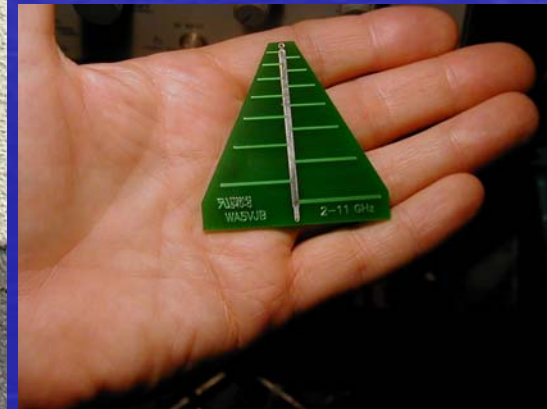


Dish

quad loop yagi



Circular & rectangular
horns



2-11GHz log
periodic

Microwave antennas give much higher gains than HF ones!

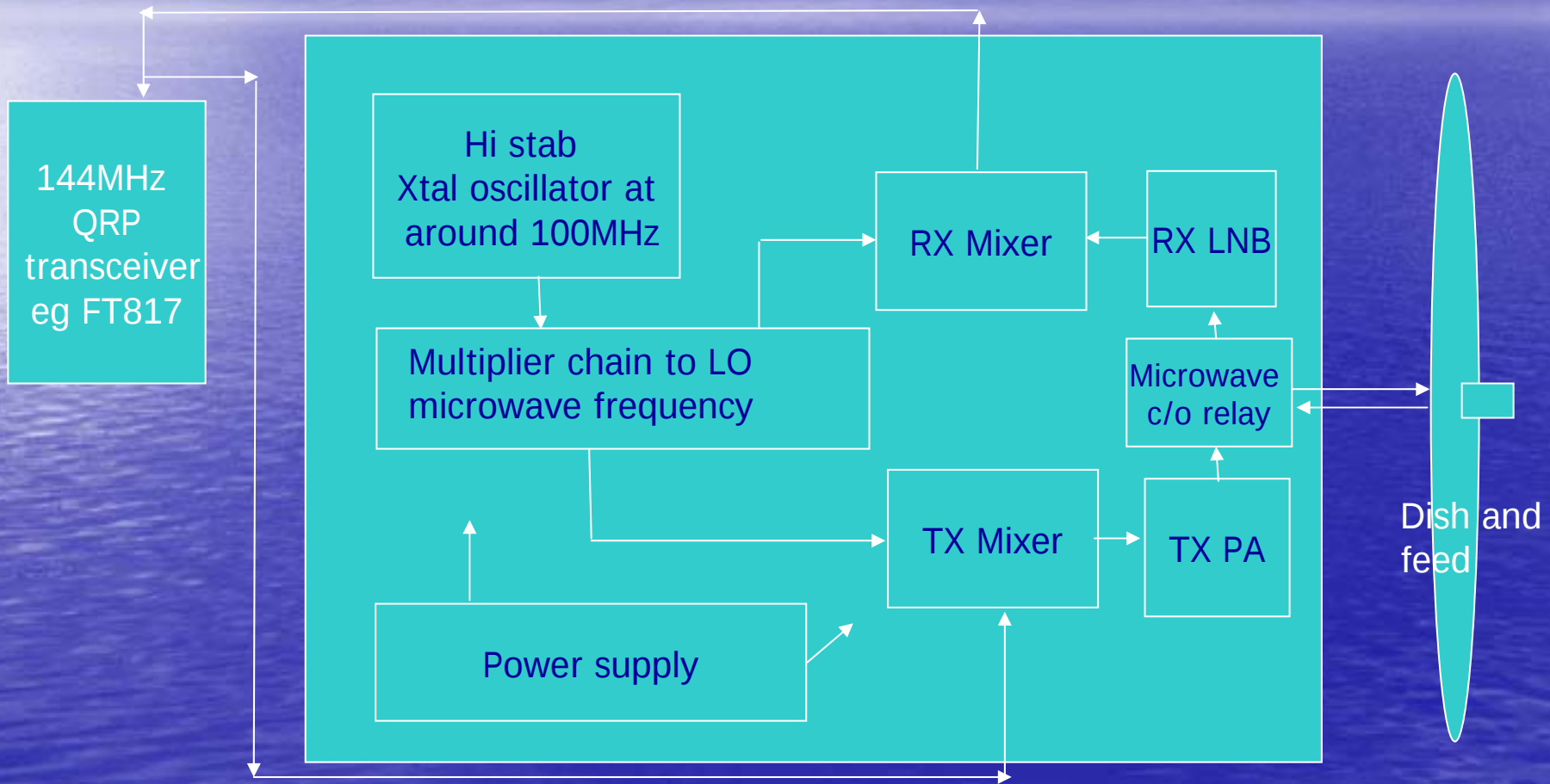
- 60cm offset dish on 10GHz = 35dB gain
- 10mW into 60cm dish -> almost 40W ERP !
- 10W into 60cm dish -> almost 40KW ERP !

- 3 ele yagi on 14MHz = 6-7dB gain (optimist!)
- 10W -> 3 el yagi = only 40W ERP

What's narrowband cw/ssb microwave all about?

- Until the mid to late 1980s, almost all microwave gear on 10GHz and above was based on the Gunn diode oscillator and point contact diode mixers
- Narrowband gear had been built by several operators but it tended to be low power and in waveguide, thus rather bulky

A modern narrowband microwave system



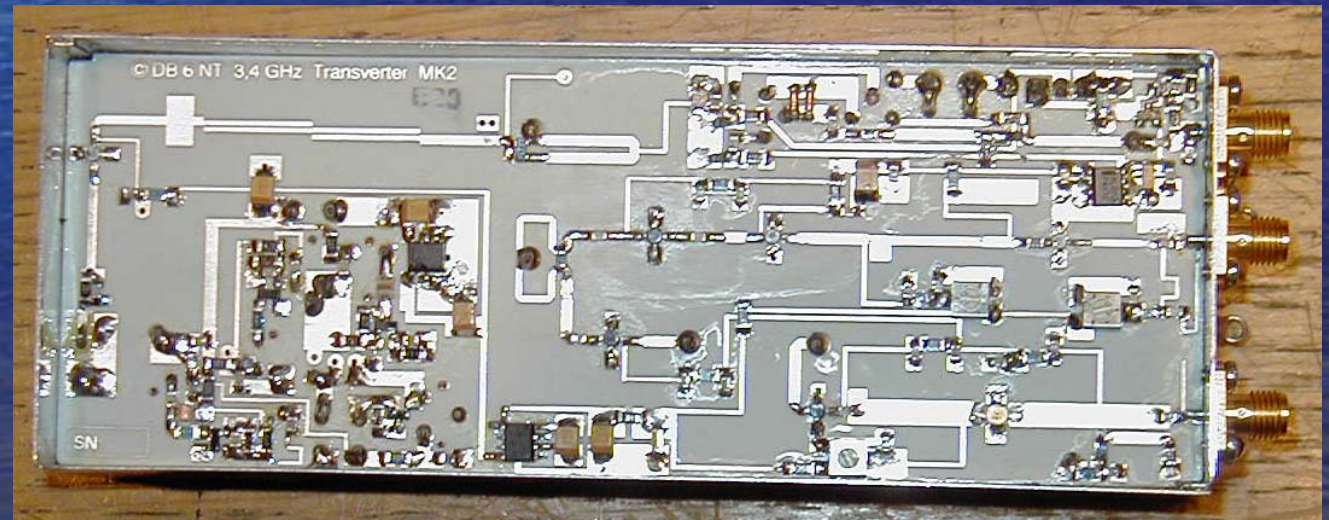
Today Michael Kuhne DB6NT rules!

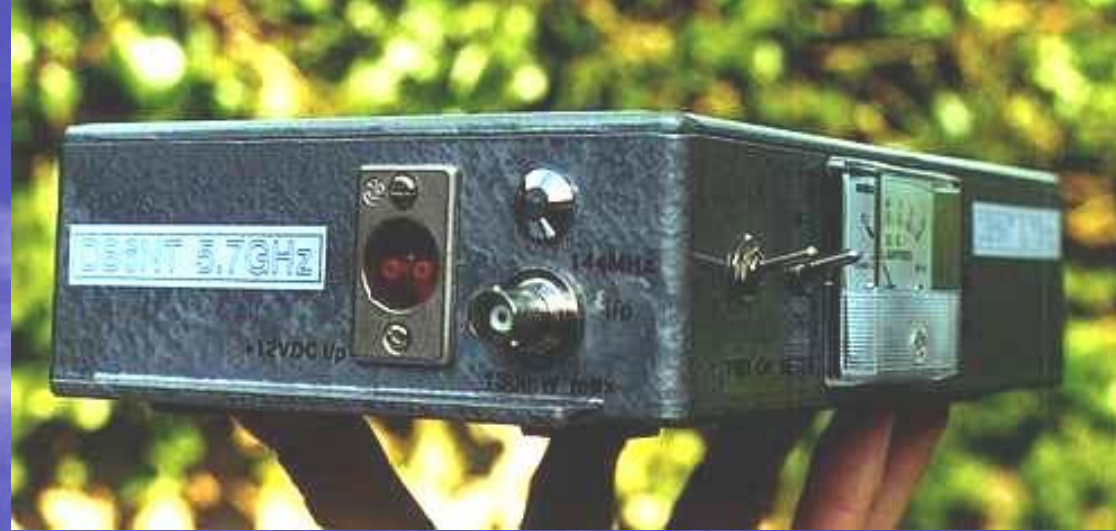


DB6NT NARROWBAND TRANSVERTER

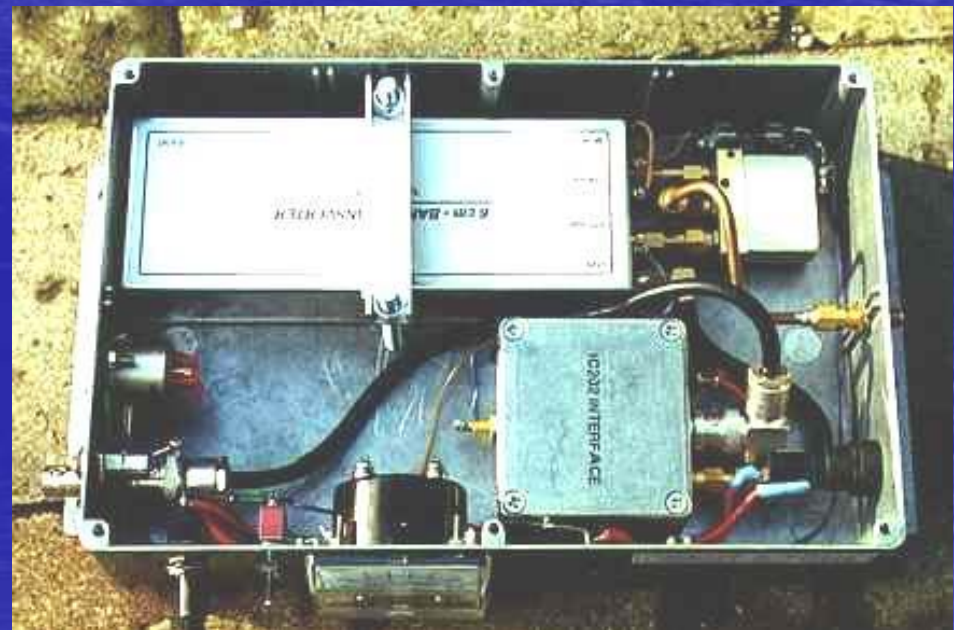
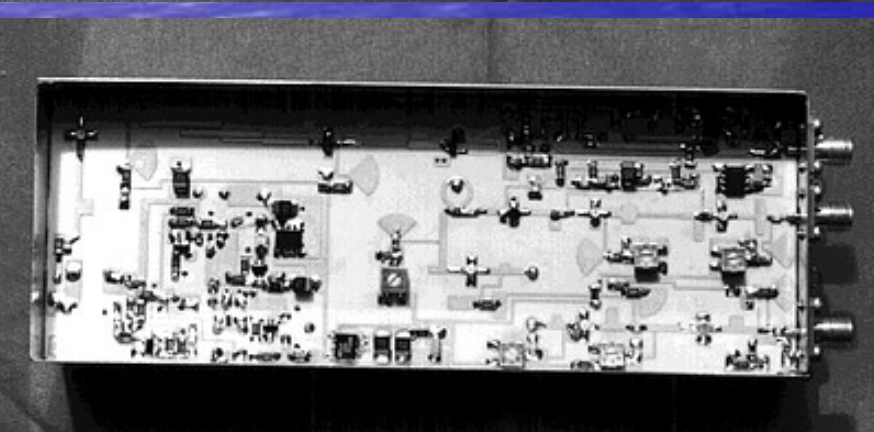
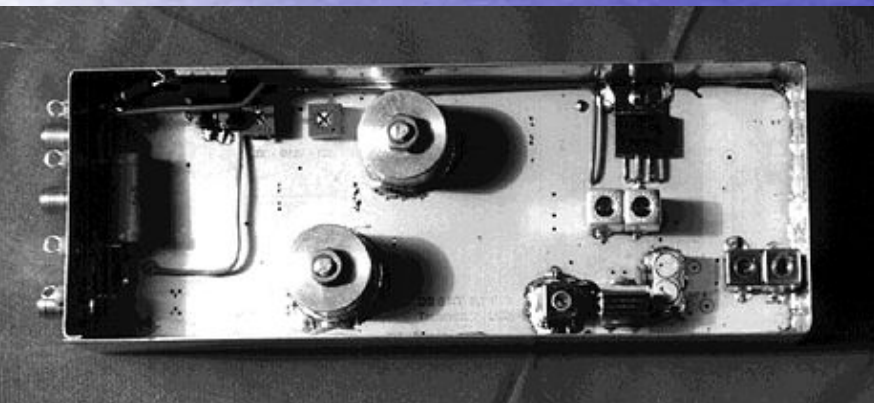


Available in
kitset or built up
form for all
microwave
bands from
1296MHz up



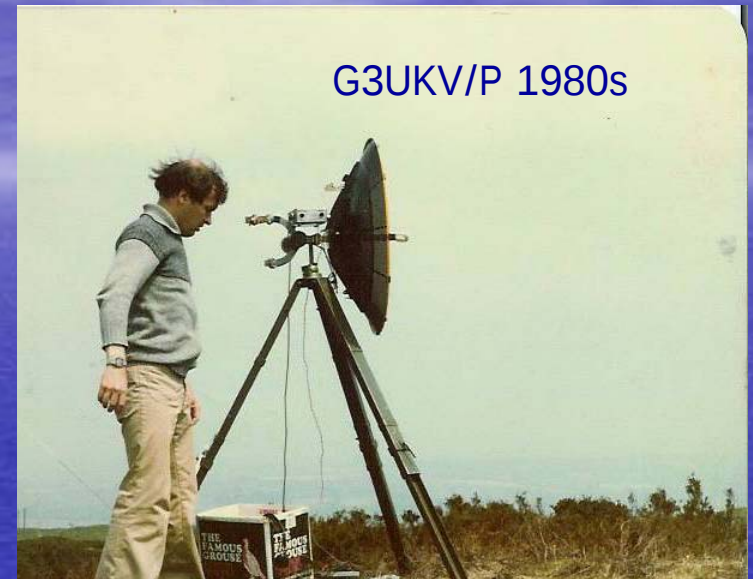


Narrowband in the 21st Century:
the DB6NT transverter route
... reliable and state of the art



The Effects of Narrowband on UK microwaving

- The gear has become more powerful and therefore greedier in terms of batteries
- Wideband FM has almost disappeared!
- Gone are the days of light weight hill topping and backpacking up Scottish mountains!
(but YOU could bring it back!)
- 'Portable' today means from a car or van
- Home station operation is now very common (unusual on 10GHz before 1985)



The WDG and DDK modules changed 10GHz in the UK for ever!

- Hundreds of amateurs have developed new skills in soldering surface mount components onto microwave quality printed circuit board
- Activity increased and new distance records

A Modern Portable Microwave Station: G3PHO/P in 2006

- SSB/CW “high” power narrowband transceivers: 5W 10GHz, 12W 5.7GHz, 15W 3.4GHz
- 4 foot dish on large, ex OB tripod
- 50 watt 144MHz talkback transceiver
- 9 element 144MHz yagi
- 20 foot mast for 2m antenna
- One or two large leisure or SLA batteries
- laptop
- All hardly back-pack portable!



Getting ready to go
out portable



Lots of gear to
carry



That's it all in the van



But there's lots left filling
up the garage!

G3PHO/P 2006



The ex Outside Broadcast tripod makes a really strong base for the four foot diameter dish at G3PHO/P.

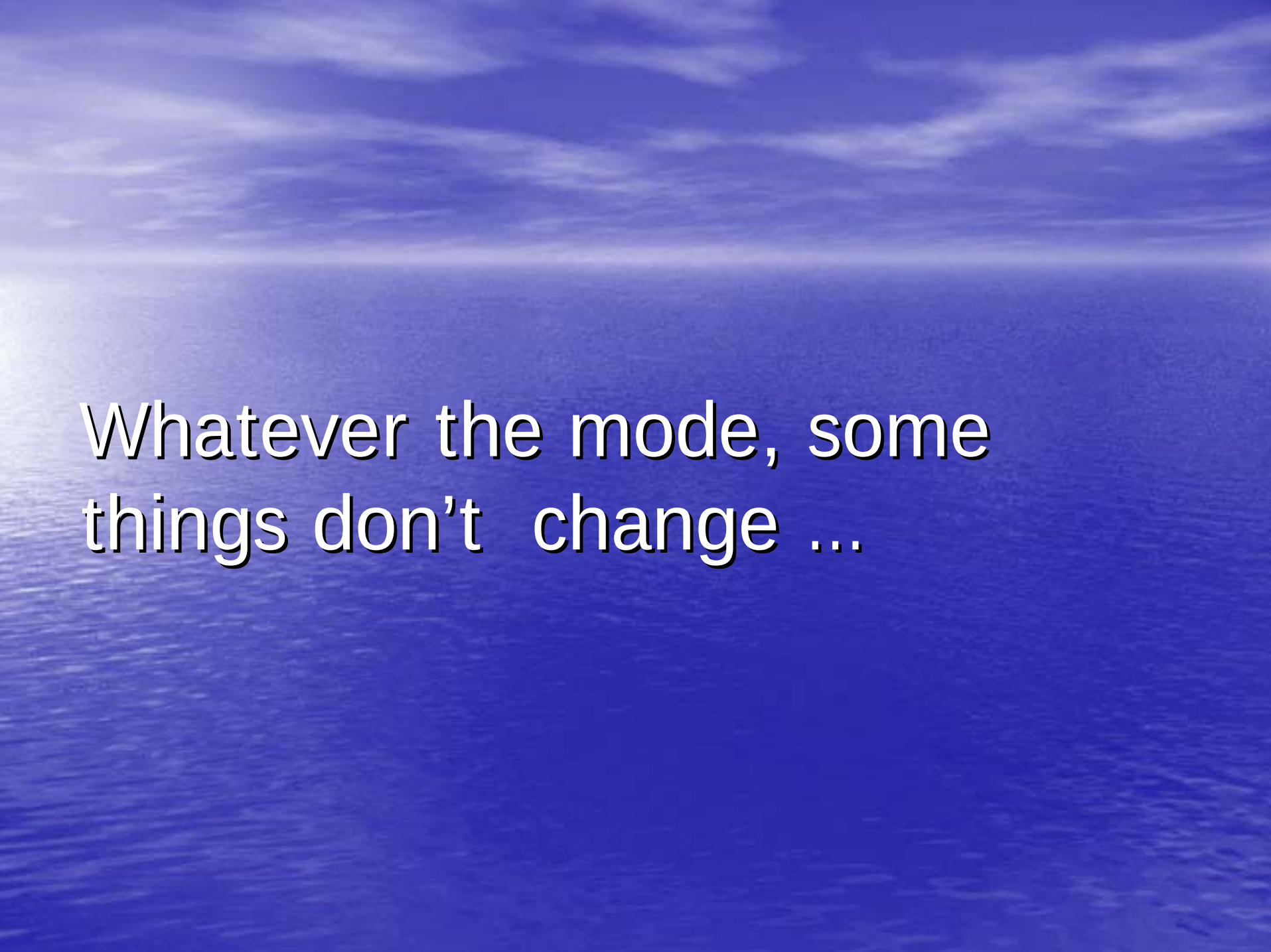
Once set up, the dish can be quickly set to any bearing with a 1 degree accuracy ... essential for dishes of this size at 10GHz.



5.7GHz and 10GHz transverters

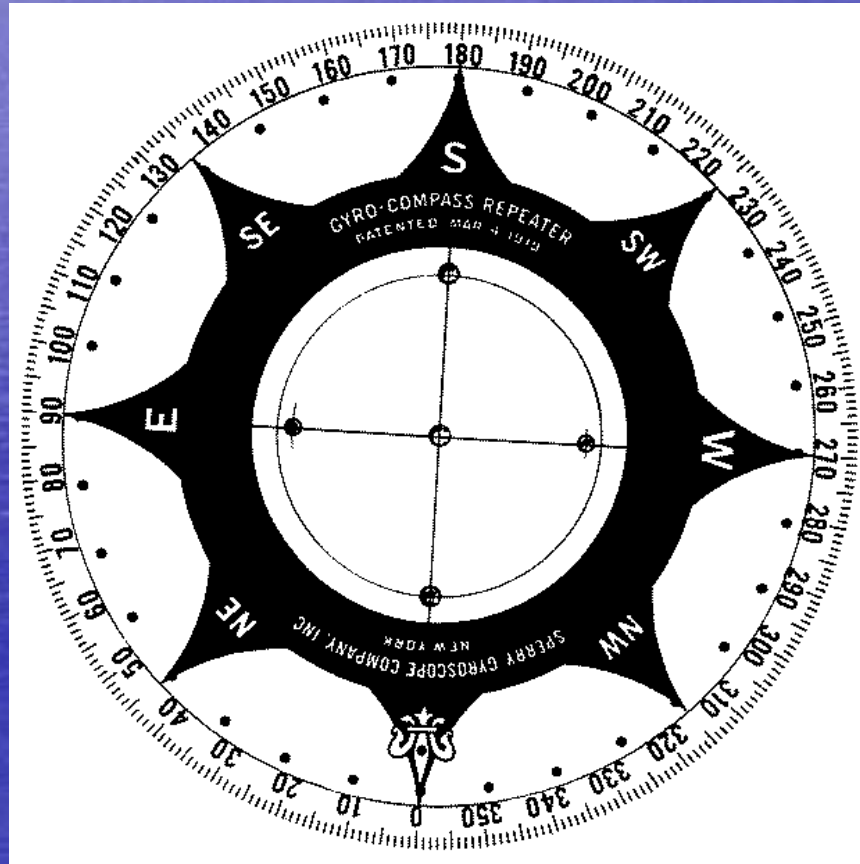
Operating position at G3PHO/P

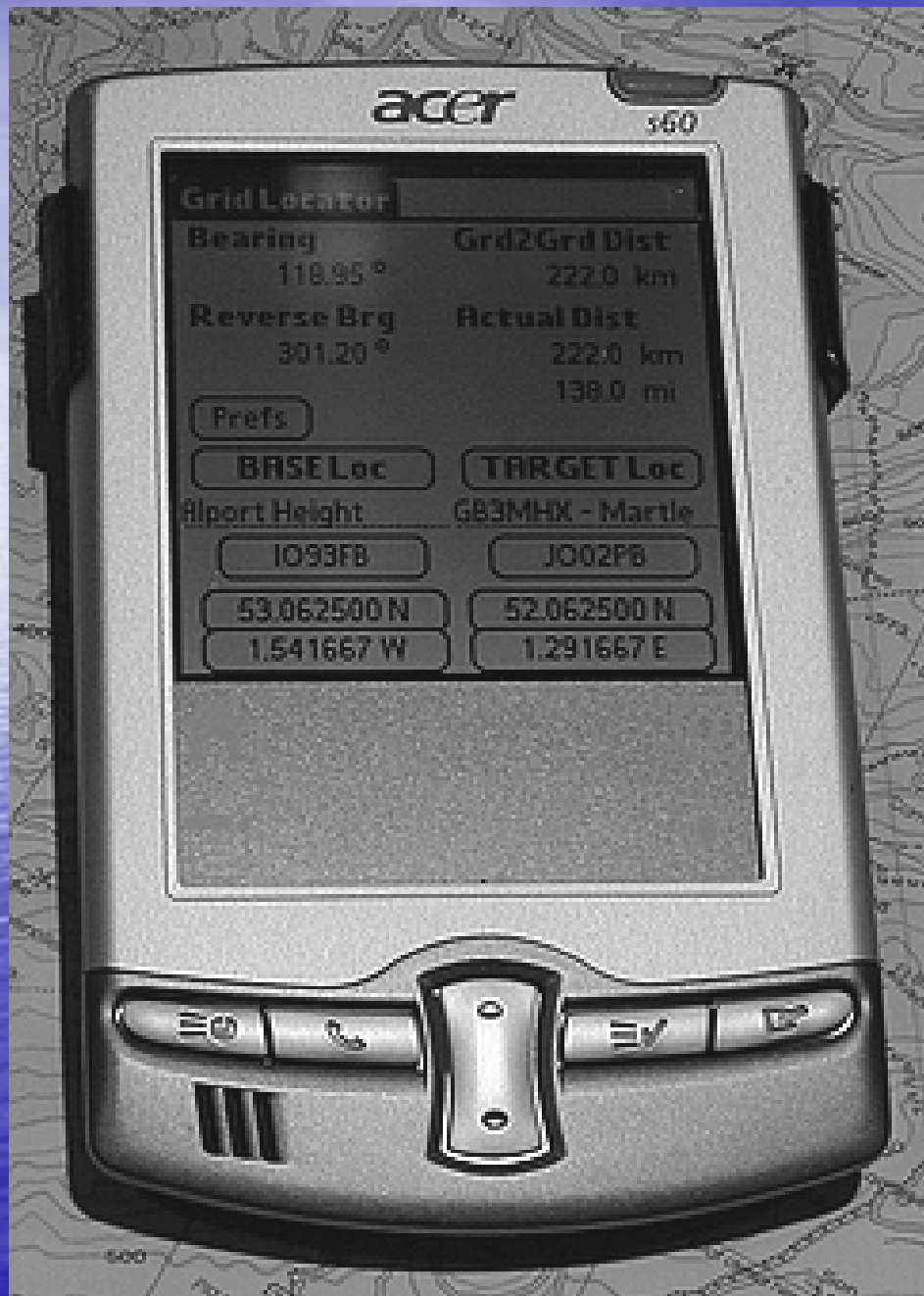




Whatever the mode, some
things don't change ...

You still have to point the dish accurately, to within ~ 1 degree





You need to
have accurate
bearing
information to
the other
station

You need to know the other station's frequency



A clear take off makes for better signals

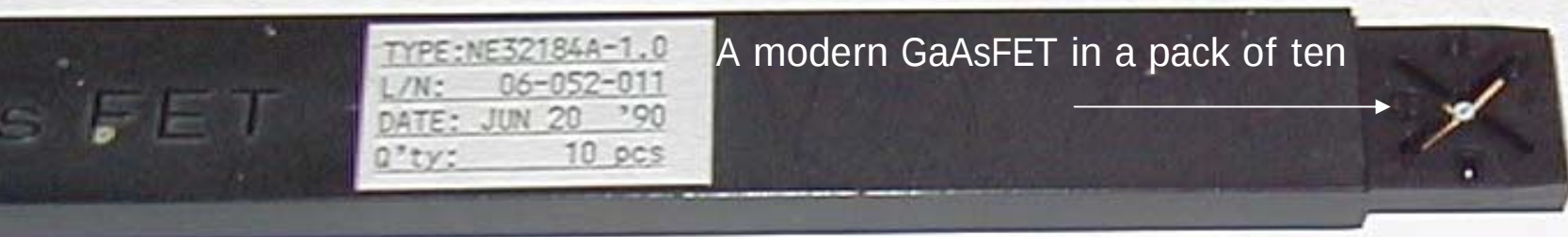


Antenna supports must be firm
to withstand strong winds



MICROWAVE COMPONENTS

Some modern (and not so modern!) microwave components ...



A modern GaAsFET in a pack of ten

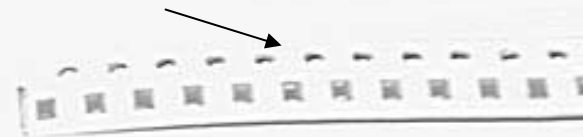
Gunn diode 1980's vintage



"bog standard" transistor

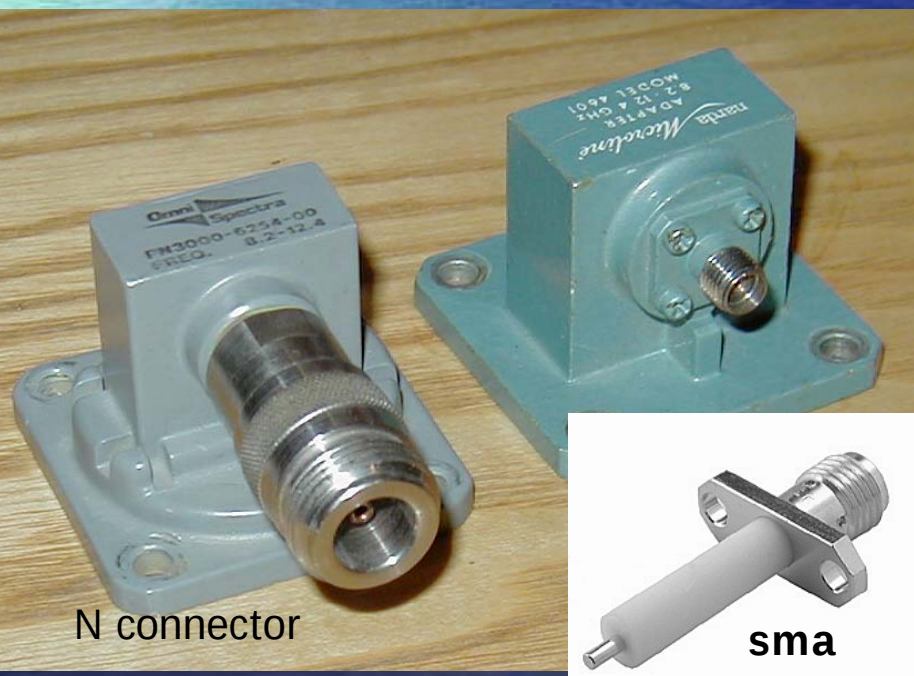


A strip of chip capacitors



A strip of modern surface mount bipolar transistors





Feedlines at microwaves vary from waveguide (top left) which gets smaller in cross section the higher in frequency you go, to semi rigid and Heliax coax lines (top right).

Connectors are critical! The sma connector shown in the inset photo to the lower left is the best available to amateurs. The N-type connectors shown are also very useful to 10GHz. Most other common types (eg PL259) are USELESS!

Microwaving in the 21st Century offers a lot to anyone who likes home construction

- New skills have to be acquired ... such as soldering very small components to pcb boards and aligning homemade transceivers
- Easily available kits, especially from DB6NT in Germany and G3WDG in the UK
- Ready made modules are available for those who are scared of making a mess of their own!



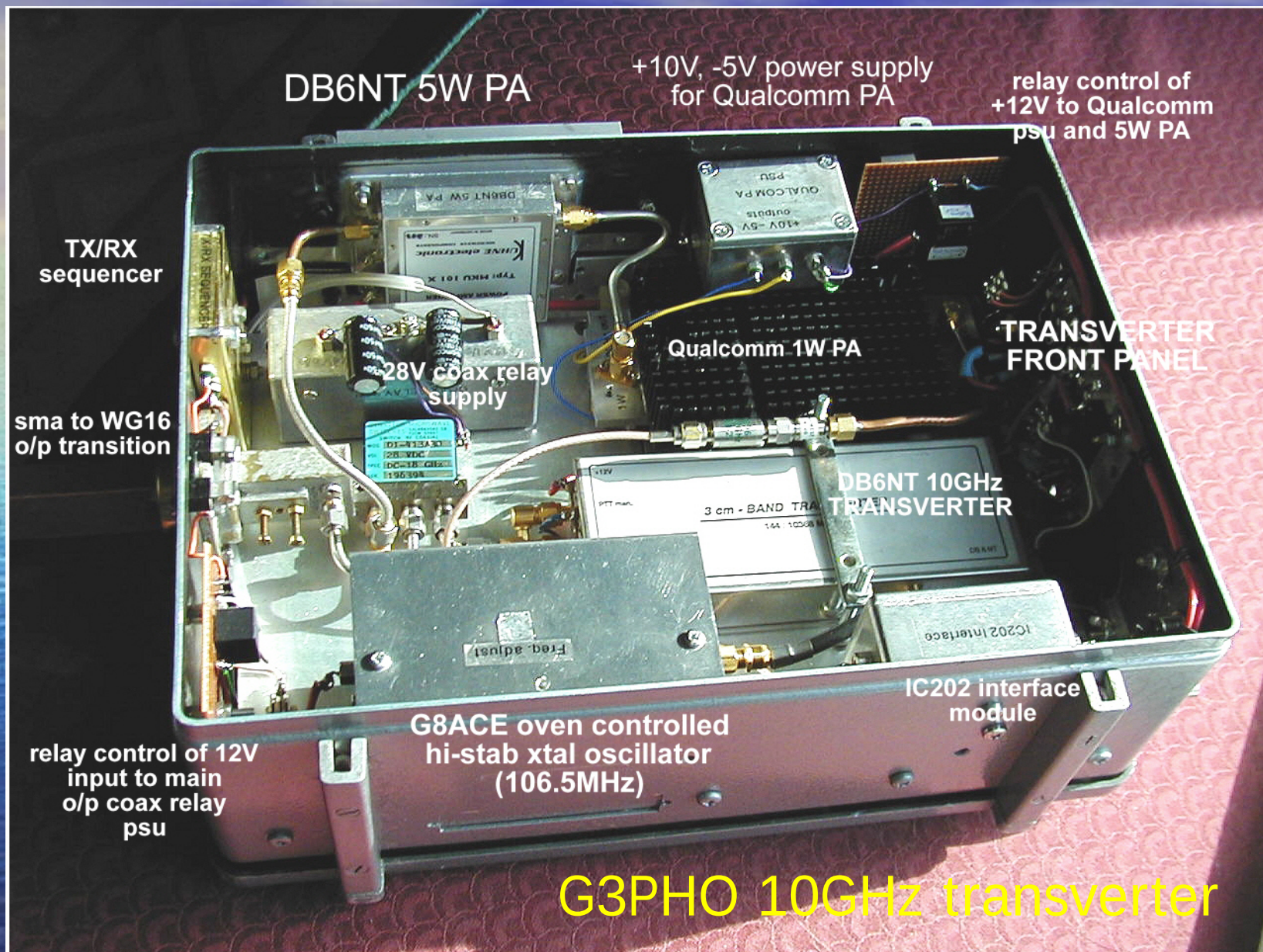
It helps if you have a well stocked “junk box”



Microwavers soon become avid collectors of spares!

**10GHz
5W narrowband
transverter
by G3PHO**





DB6NT 5W PA

+10V, -5V power supply
for Qualcomm PA

relay control of
+12V to Qualcomm
psu and 5W PA

TX/RX
sequencer

sma to WG16
o/p transition

28V coax relay
supply

Qualcomm 1W PA

TRANSVERTER
FRONT PANEL

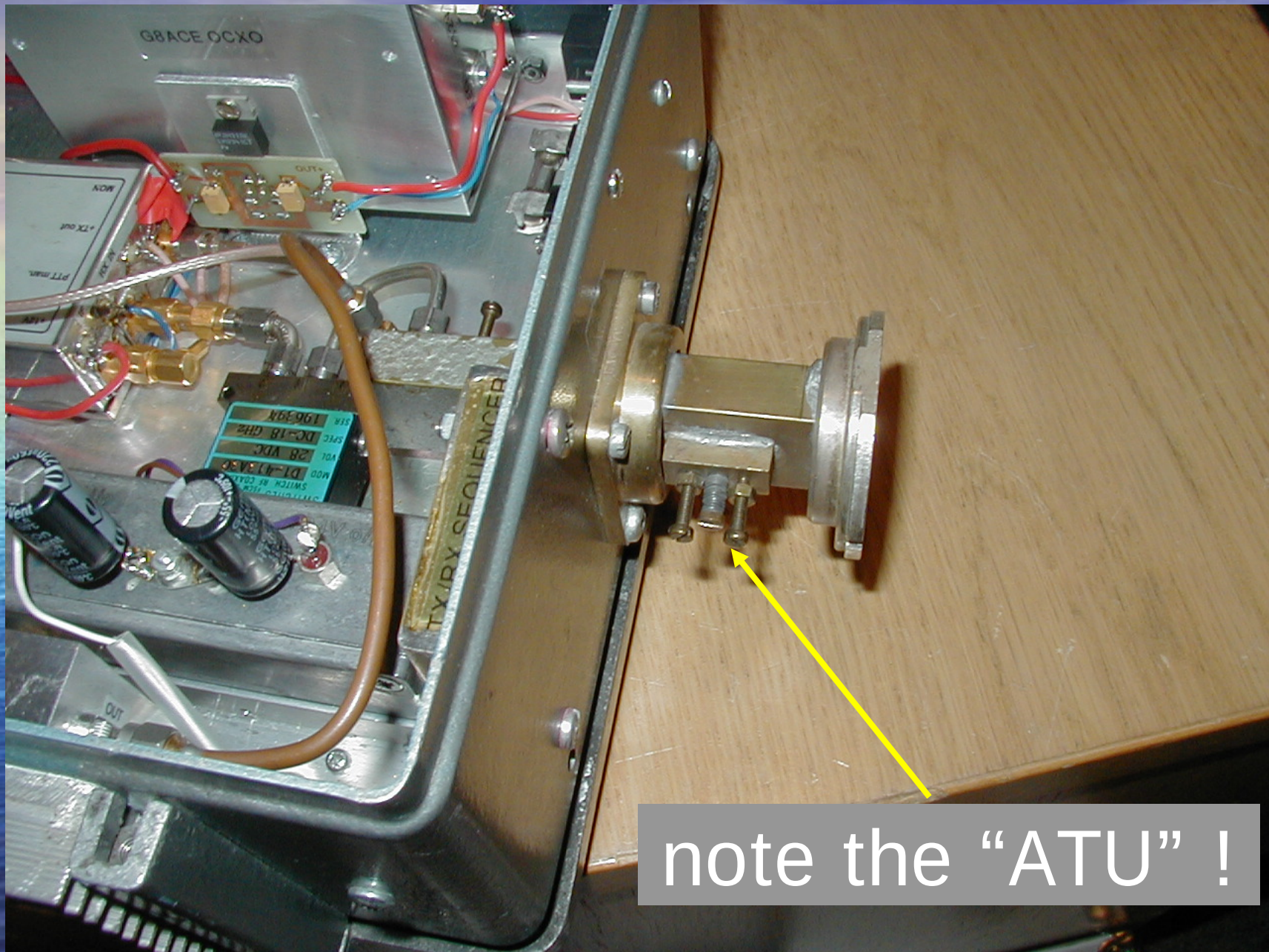
DB6NT 10GHz
TRANSVERTER

IC202 interface
module

relay control of 12V
input to main
o/p coax relay
psu

G8ACE oven controlled
hi-stab xtal oscillator
(106.5MHz)

G3PHO 10GHz transverter



note the “ATU” !

G3PHO 5.7GHz 10W Transverter built in 2001



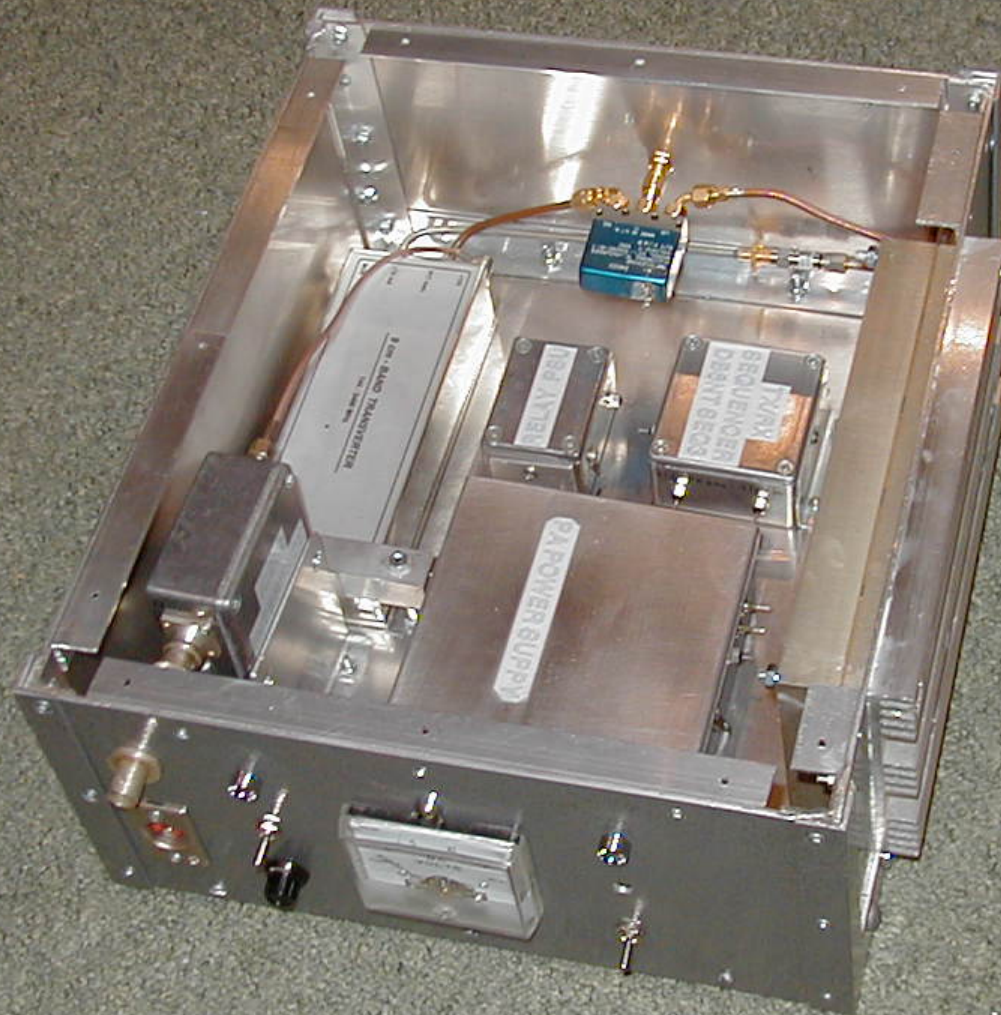


G3PHO 5.7GHz transverter



3.4GHz 14 watt transverter by G3PHO. March 2003

3.4GHz 14 watt transverter by G3PHO: March 2003



What do I need in
the way of
test gear for
microwaves?

Essential to test:

- Frequency
- Power output
- Receiver noise figure or sensitivity
- Compare with another stn.

- The simple Gunn diode gear can be set up with very basic test gear .. a multi-meter and a wavemeter.
- Multi-meters should be in every amateur radio shack but 10GHz wavemeters are not so common! Look out for them at rallies or contact your local amateur microwave “elmer”!

Cavity wavemeter

It's quite accurate to within a MHz or so, good enough for wideband modes.

In waveguide and is therefore good for the simple Gunn diode gear.

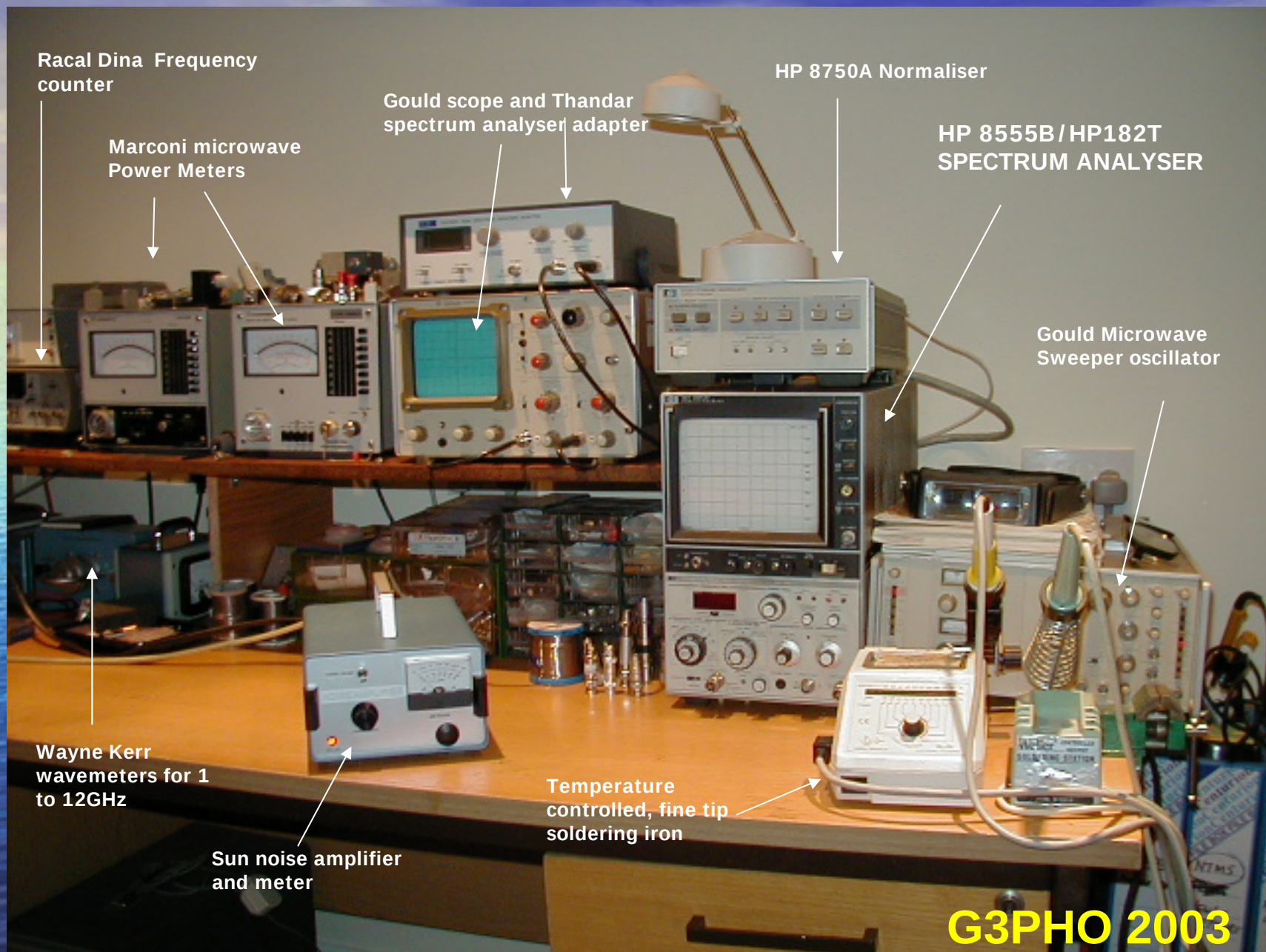


Narrowband (ssb/cw) gear needs more sophisticated test gear

- Access it through more experienced local microwavers
- or the UK Microwave Group's network of regional technical support
- or at amateur microwave meetings (called "roundtables")
- Your local university or college may also have friendly member of staff who may help.
- Don't be afraid to ask local amateurs for help!

Here's some of the test gear at G3PHO

- This is after over 30 years of being a microwaver !
- It is not expensive stuff
- Much is second hand surplus
- Some is home-made and calibrated on professional gear elsewhere
- It's available through the UKuG Elmer scheme for local microwave "newbies" to test their newly built gear



Racal Dina Frequency counter

Marconi microwave Power Meters

Gould scope and Thandar spectrum analyser adapter

HP 8750A Normaliser

HP 8555B/HP182T SPECTRUM ANALYSER

Gould Microwave Sweeper oscillator

Wayne Kerr wavemeters for 1 to 12GHz

Sun noise amplifier and meter

Temperature controlled, fine tip soldering iron

G3PHO 2003

0-50dB
10GHz
attenuator

Adret 90-120MHz
synthesized oscillators
locked to highly accurate
frequency standard

Multiplier to
give
markers on
all
microwave
bands to
47GHz.
Accurate to
within a part
of 1kHz

Hi-stability frequency standard giving
outputs at 10MHz, 5MHz and 1MHz.
Accurate to 0.03Hz at 10MHz

FREQUENCY MEASURING AT G3PHO





Above: Frequency counter, HP power mete
Below: HP141 spectrum analyser system to 47GHz



Above: Marconi power meter to 24GHz
Below: Ailtech 7514 Noise Figure Meter to 12GHz





MICROWAVE BEACONS



EMLEY MOOR BEACONS

Located in IO93EO on the edge of the “microwave wilderness”!

- GB3MLE on 1296.930MHz
- GB3MLE on 10368.925MHz

Bell HILL BEACONS

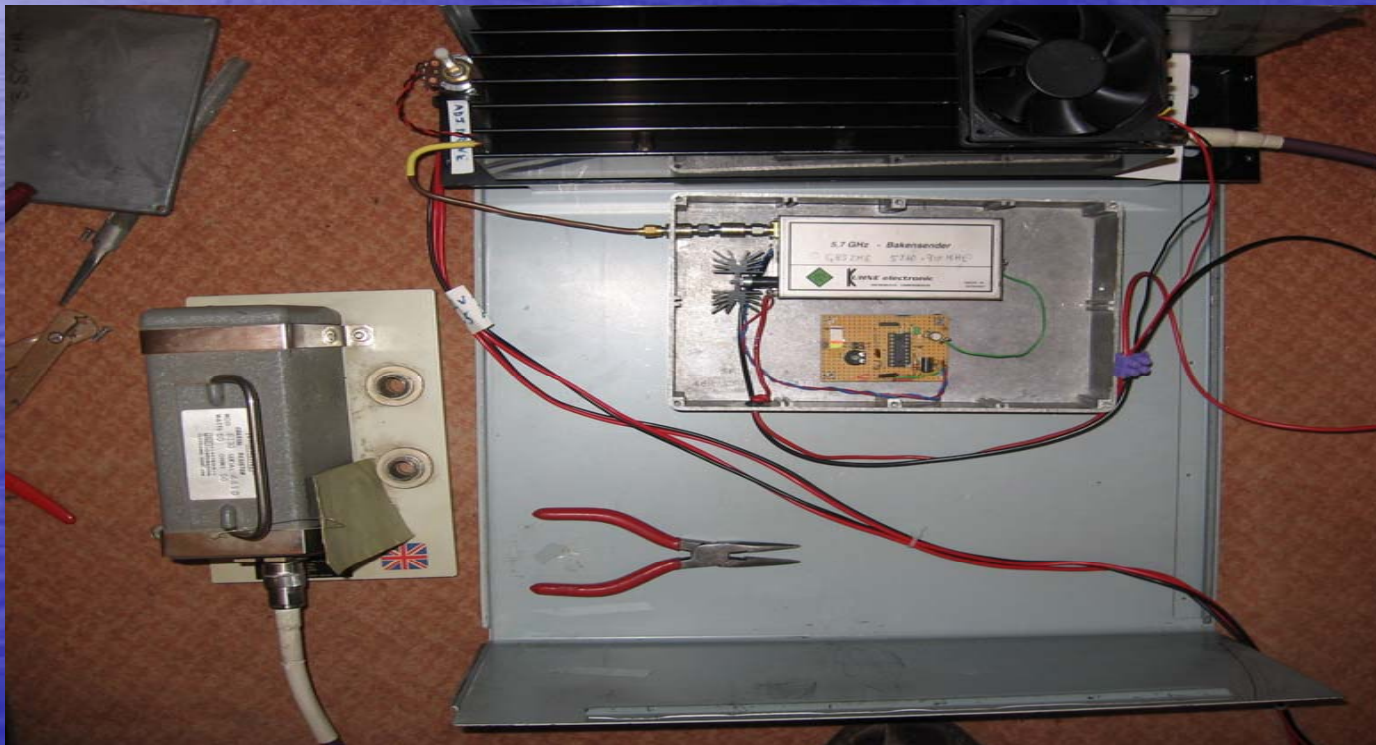
IO80UU South Coast of England



- Beacons on all bands from 2.3GHz to 47GHz inclusive!
- The beacons are highly accurate and stable in frequency
- GB3S## series callsigns

GB3ZME Beacons, TELFORD IO82SQ

- 3400.910 MHz, 5760.910 MHz, 24048.910 MHz – Right here above your heads!



Beacon Lists

- www.microwavers.org

FREQUENCY STANDARDS

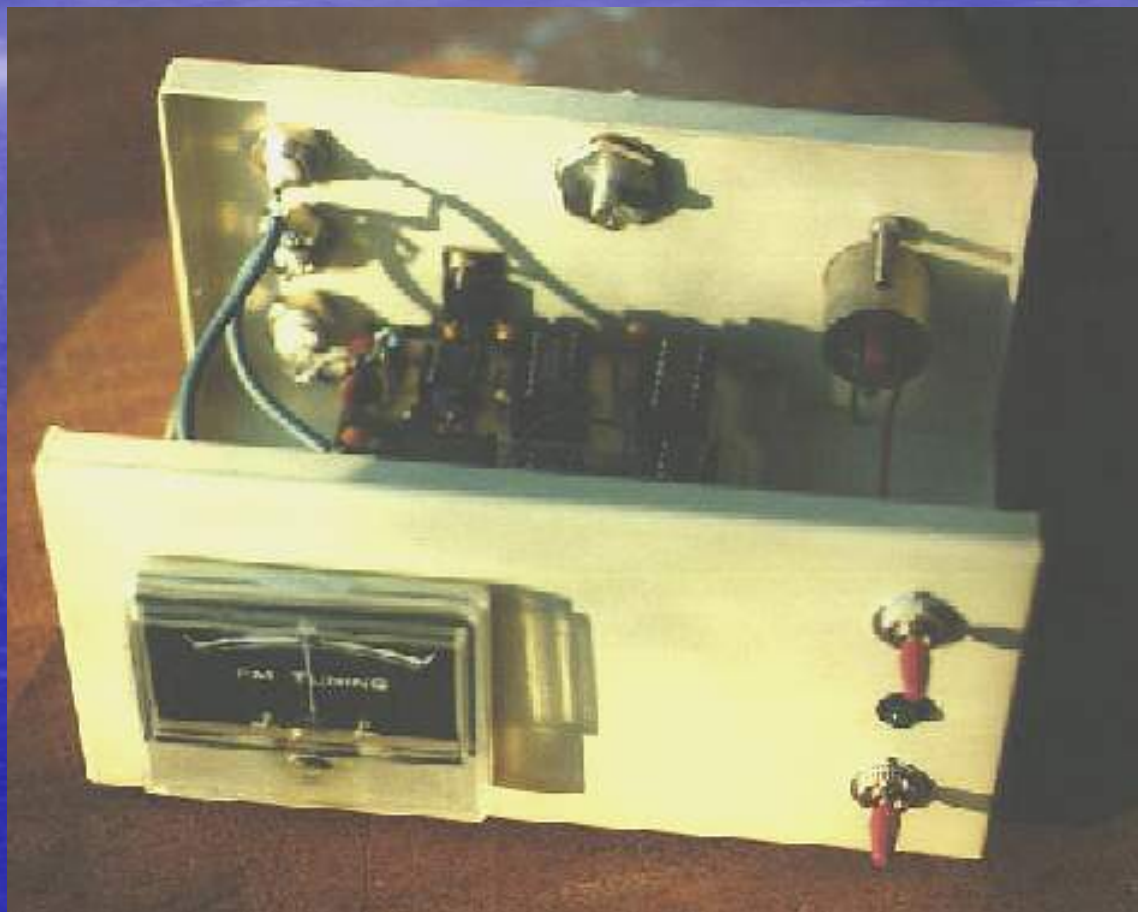
Frequency standards and counters need calibration if accuracy to within a few Hz at 24GHz is to be achieved. Lock counters to an external high standard source:

- MSF on 60kHz
- Droitwich (Radio 4) on 198kHz
- Sync pulse from ZDF on the Astra satellite
- GPS system

The “Poor Man’s Caesium Clock”

This easy-to-build frequency standard uses the sync pulses from ZDF on the Astra satellite to generate highly accurate markers at 10MHz, 1MHz and 100Hz.

Use it to lock your frequency counter and other oscillators



(see RadCom January 1999 and additional info April 1999)

Measuring Noise figure at microwaves ... the cheap alternative!

This home-made unit, the G4COM noise figure meter, can give comparative readings and show improvements up to 10GHz but it can't give absolute values.



See RSGB Microwave Handbook
Volume 2

Using Sun noise, the NF of a receiver can be calculated

Designed by G4NNS

Easy to make.

Basically a very high gain amplifier covering 144 to 146MHz.

A microwave transverter with an IF of 144MHz plugs into it and the transverter's antenna is pointed to the Sun. Sun noise registers on the meter and be used to adjust dish antenna feeds and receive amplifiers



It can also measure noise from the noisy “hot” ground and compare it to the low noise, “cold” sky thus enabling the NOISE FIGURE of the microwave receiver to be assessed.

MICROWAVE ROUNDTABLES

Three main ones each year

- Martlesham (Eastern England)
- R.A.L (near Oxford)
- Crawley (South of London)

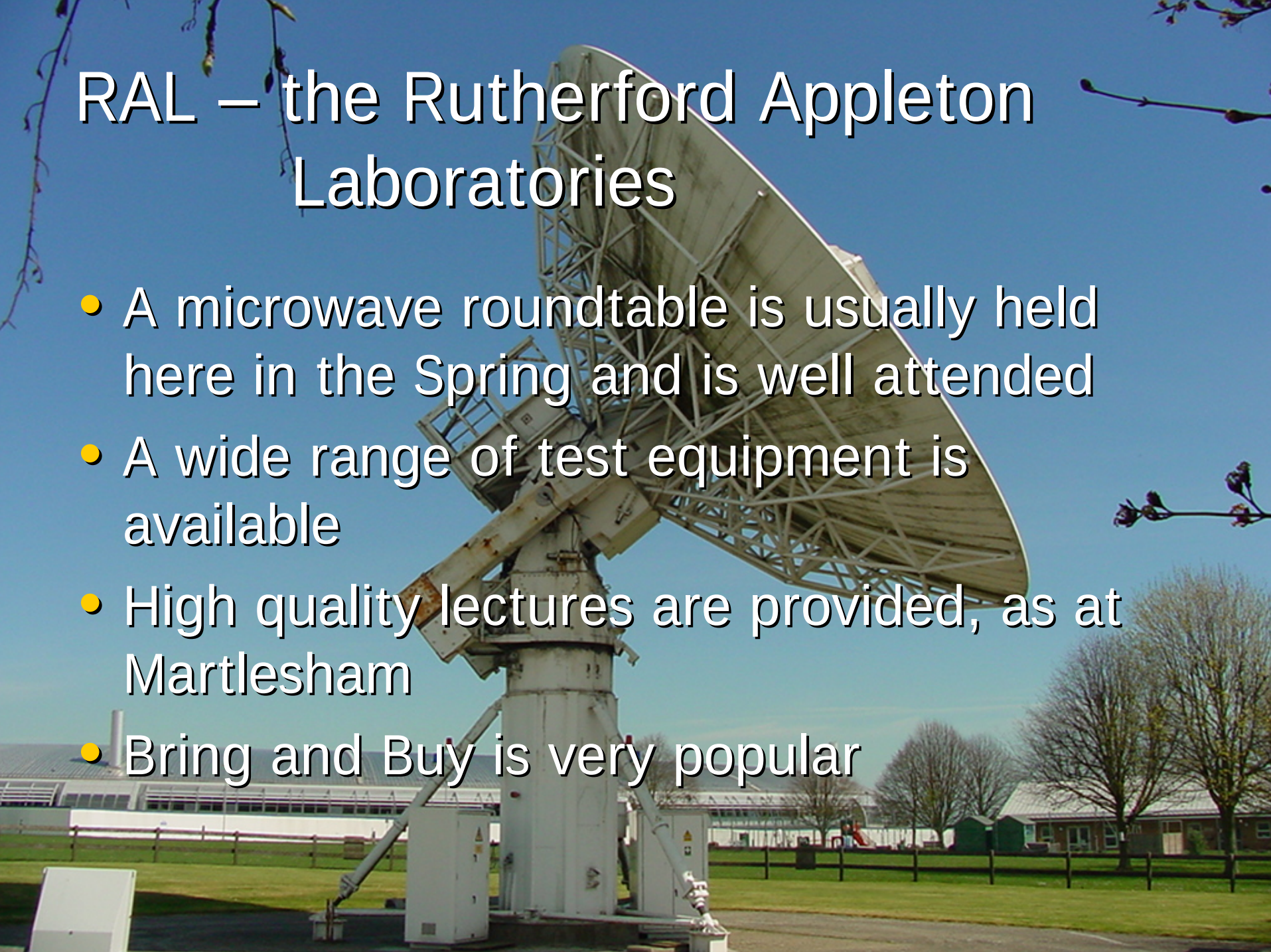
Martlesham

Microwave Round Table

- ❑ Talks
- ❑ Bring & Buy
- ❑ Meet friends
- ❑ Antenna test range
- ❑ Test gear
- ❑ Overseas visitors
- ❑ Two day event
- ❑ Saturday night dinner



RAL – the Rutherford Appleton Laboratories



- A microwave roundtable is usually held here in the Spring and is well attended
- A wide range of test equipment is available
- High quality lectures are provided, as at Martlesham
- Bring and Buy is very popular

So how can I get into microwaves ?

- Check out the “World Above 1000MHz” website at www.g3pho.org.uk
- Make the simple beginner’s 10GHz wideband FM transceiver described on the website ... work in partnership with a friend
- Subscribe to the UK Microwave Group and receive its newsletter Scatterpoint.
- Visit www.microwavers.org, the official UKuG website

How do I find out more?

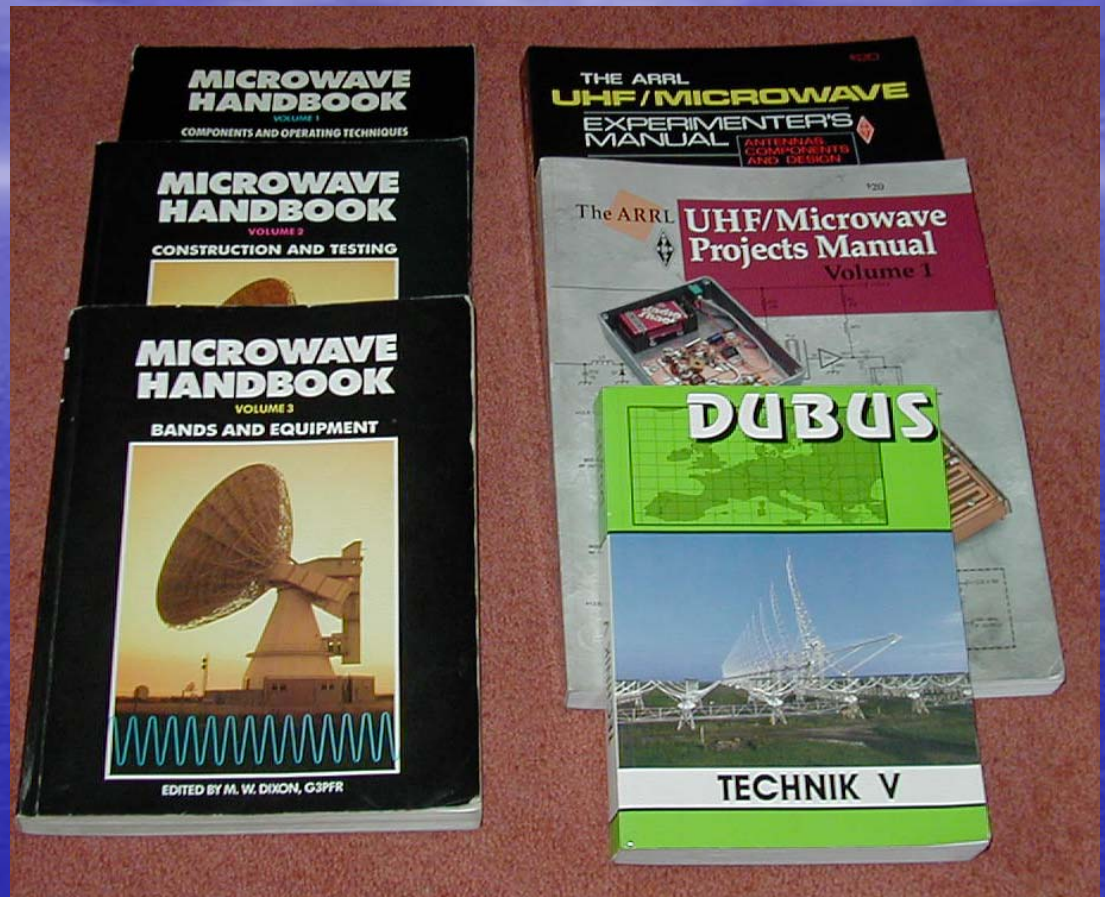
- Search the Internet ... there are hundreds of great amateur microwave websites.
- Buy or borrow basic microwave books (see later)
- Try to visit a microwaver out in a portable contest or activity day (dates shown on www.microwavers.org) ... you'll be made welcome!

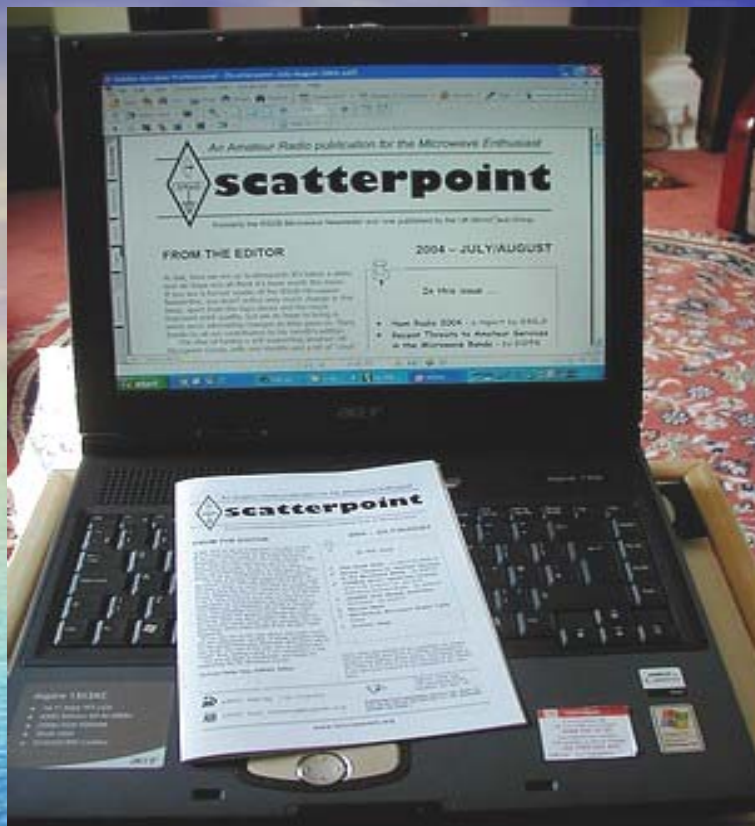
Microwavers' “bibles”!

The RSGB
Microwave
Handbook

ARRL Microwave
Manuals

Dubus Technik
volumes 1 to 6

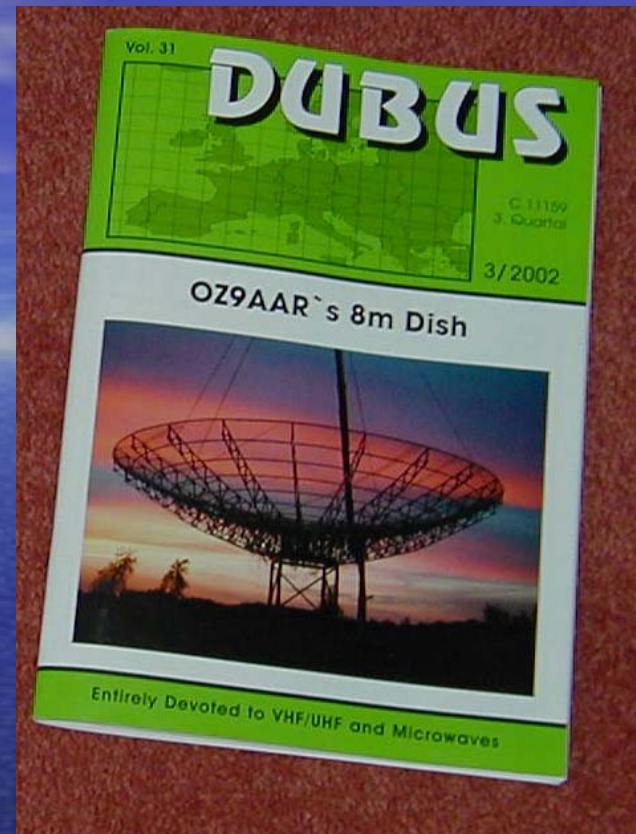




SCATTERPOINT...
UK Microwave Group newsletter

- 10 issues a year
- 16 page A5 black and white publication

See www.microwavers.org for details



DUBUS Magazine

- 4 issues a year
- Published in German and English

Contact G4PMK for details

WHAT DOES THE UK MICROWAVE GROUP DO?

- Supports and represents all UK microwavers at RSGB level. It's our ONLY voice !
- Organises an annual contest program
- Offers achievement awards and trophies
- Supports and organises microwave conventions ("round table meetings")
- Is a source of help and guidance for newcomers
- Produces Scatterpoint ten times a year

UK MICROWAVE CONTESTS

The background of the slide is a photograph of several radio towers and antennas silhouetted against a sunset sky. The towers are made of metal lattice and have various antennas attached, including large parabolic dishes and long horizontal arrays. The sky is a mix of orange, yellow, and blue, with some clouds visible. The overall scene is a typical amateur radio station setup.

Each year the UK Microwave Group runs ...

- Monthly 10GHz and 5.7GHz cumulatives from May to October
- 24GHz/47GHz cumulatives
- 1.2GHz/2.3GHz/3.4GHz contests

In addition the RSGB and IARU Region 1 holds “432MHz up” contests in May and October’

There are also monthly short evening contests run by RSGB as well as numerous ones in mainland Europe

UKuG CONTEST TROPHIES



G3JMB low
power
10GHz
Trophy



G3RPE
10GHz
Trophy



G3KEU 5.7GHz Memorial Trophy

That's it for now ...

- The rest is up to you!
- Get out there and have a go at microwaves
- You'll not regret it
- It will liven up your amateur radio!
- And give you a real sense of achievement.
- You'll no longer be a "black box operator"!



Microwave stations around the world

G4NNS - Andover



G4NNS's home station

- Brian lives in Andover and is a keen microwaver
- He has a large dish for “moonbounce” (EME) work on 10GHz and has made many contacts into North America this way
- He is also very active on terrestrial 10GHz and 5.7GHz
- The trees around his house are a real nuisance!

**John, W3HMS out portable in
Eastern USA on 10 and 24GHz
during 2002**



G4ALY IO70VL , Cornwall



EXAMPLES OF UK PORTABLE MICROWAVE STATIONS



Paul M0EYT/P uses 2.4GHz WLAN for internet talkback !





Portable
microwavers
like hard work

The G4ZXO/P team pull
their microwave gear up
to the summit of the hill
using a set of wheels and
the VHF mast as a
trailer!



G4ZXO/P IO90TV South Coast



G3PHO/P in IO85VE (in the microwave “wilderness”) July 2004





G3PHO/P with 5.7 and 10GHz, Blakey Ridge, North York Moors, IO94MI

G4MAP

TO
G3PHO/P
TNX FOR **3cm** QSO
ON **22/8/99**
AT **1705** GMT
MODE **SSB**
UR SIGS **57**

12dB Log Periodic
2m 50 W
70cm 15 W
23cm 4 W

60cm Dish
13cm 1 W
3cm 1 W
10m AGL

SO947698 120m ASL *73 de Andy*
IO82XH

Andy, G4MAP has this fine home station set up on 2.3GHz and 10GHz. His log periodic VHF beam works on all bands from 6 metres to 70cm

G8IFT/P South Birmingham RS and Telford & DARS G3ZME/P site



Here they are set up on Brown Clee Hill in Shropshire
with gear for most microwave bands to 47GHz.

G3ZME/P Real Portable (no block house access.....)

- May 2003, 1.3, 3.4, 5.7, 10, 24, 47 GHz





The home station of G0RRJ near Andover, IO91FF



Microwaves French style! This is the F1DBE/P and F1PYR/P group. They certainly don't skimp on their food when out overnight in a portable contest!





The End

OR IS IT THE BEGINNING FOR YOU ?