

GHz Bands? Contesting? You've got to be kidding!



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GHz Bands and Contesting

- What are the Microwave bands?
- Excuses for not contesting on them
 - Ah, but the QSO rate is so low
 - and you don't work any DX!
 - and it's very expensive!
 - and it's all too technical for me!
- Microwave contest operating
- Key technology drivers



GHz Bands and Contesting

• “Microwave”

- 1240 - 1325MHz (23cm) Secondary
- 2310 - 2450MHz (13cm) Secondary
- 3400 - 3475MHz (9cm) Secondary
- 5650 - 5680MHz (6cm) Secondary
- 5755 - 5765MHz Secondary
- 5820 - 5850MHz Secondary
- 10000 -10125MHz (3cm) Secondary
- 10225 -10475MHz Secondary
- 10475 -10500MHz Secondary
satellite only

• “Millimetre wave”

- 24.000 - 24.050GHz (1.2cm)
Primary shared with ISM
- 24.050 - 24.150GHz
Secondary (with written permission)
- 24.150- 24.250GHz Secondary
- 47.000 - 47.200GHz Primary
- 75.500 - 81.000GHz Primary
- 122.25 - 123.00GHz Secondary
- 134.00 - 136.000GHz Primary
- 136.00 - 141.000GHz Secondary
- 241.00 - 248.00GHz Secondary
- 248.000 - 250.000 GHz Primary

GHz Bands and Contesting

Some GHz-Bands Contest statistics 2013

	1.3GHz		2.3GHz		3.4GHz		5.7GHz		10GHz		24GHz		47GHz		76GHz	
	entries	max QSOs	entries	max QSOs	entries	max QSOs	entries	max QSOs	entries	max QSOs	entries	max QSOs	entries	max QSOs	entries	max QSOs
Totals	551.0	642.0	176.0	224.0	71.0	49.0	52.0	56.0	99.0	118.0	16.0	18.0	1.0	1.0	1.0	1.0
Average	42.4	49.4	14.7	18.7	5.9	4.1	3.7	4.0	6.6	7.9	2.7	3.0	1.0	1.0	1.0	1.0
other totals	21.0	76.0	14.0	32.0	10.0	13.0	13.0	33.0	51.0	84.0	16.0	18.0	1.0	1.0	1.0	1.0
other average	5.3	19.0	4.7	10.7	3.3	4.3	2.6	6.6	8.5	14.0	2.7	3.0	1.0	1.0	1.0	1.0
UKAC totals	530.0	566.0	162.0	192.0	61.0	36.0	39.0	23.0	48.0	34.0						
UKAC averages	58.9	62.9	18.0	21.3	6.8	4.0	4.3	2.6	5.3	3.8						

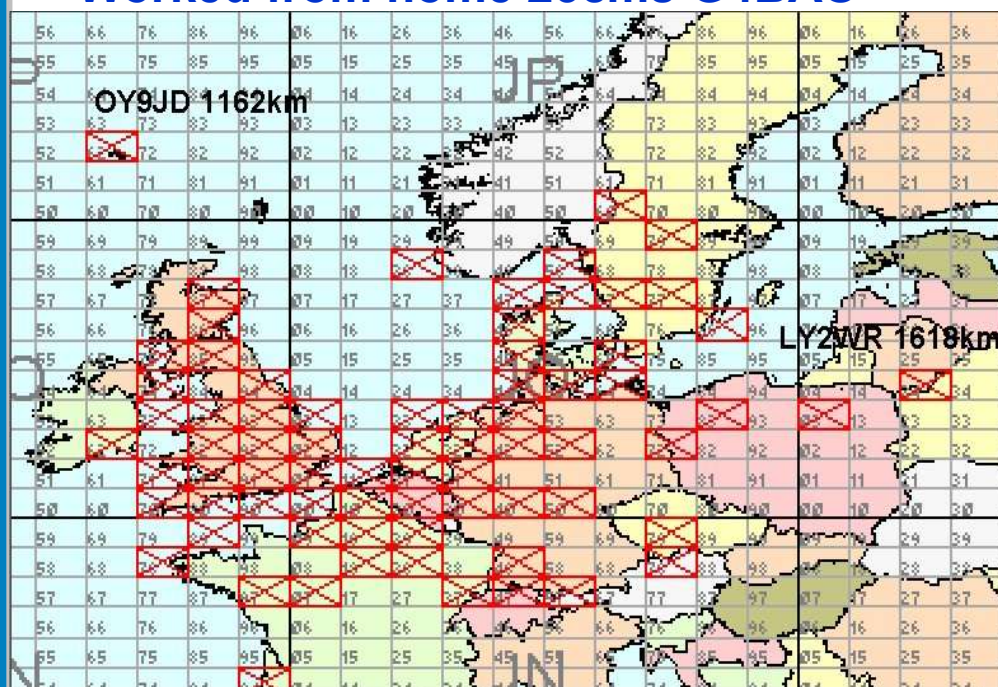
other vs UKAC 8.92% 30.21% 25.93% 50.00% 49.18% 108.33% 60.00% 258.26% 159.38% 370.59%

Source rsgbvfhcc and microwavers.org

GHz Bands and Contesting

So what can be worked?

- Worked from home 23cms G4BAO



- 8 metres above sea level!
- Mainly with 35 Watts or less

UK terrestrial records October 2013

1.3GHz	2617km
2.3GHz	1329km
3.4GHz	1137km
5.7GHz	1244km
10GHz	1429km
24GHz	408km
47GHz	203km
76GHz	94km
134GHz	17.7km
145GHz	1.29km
Light (red)	129.1km

GHz Bands and Contesting

#3 - But it's Really Expensive!

- **Microwave equipment - New**

- (approx. prices November 2011 assuming you have a 2m multimode driver)

1296/144 MHz 25W DEMI transverter	£480
23 element Tonna yagi + coax	£80
Total cost	£560
DB6NT 10GHz transverter	£450
Surplus coax relay	£10
Waterproof Box to put it all in	£10
Surplus Sky dish and homemade feed	£10
Total cost	£480

GHz Bands and Contesting

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A new D - STAR Setup?

Icom IC-E2820	£486
Comet GP-1 antenna	£70
Total cost	£556

A decent WARC Bands setup?

Cushcraft A3WS beam	£500

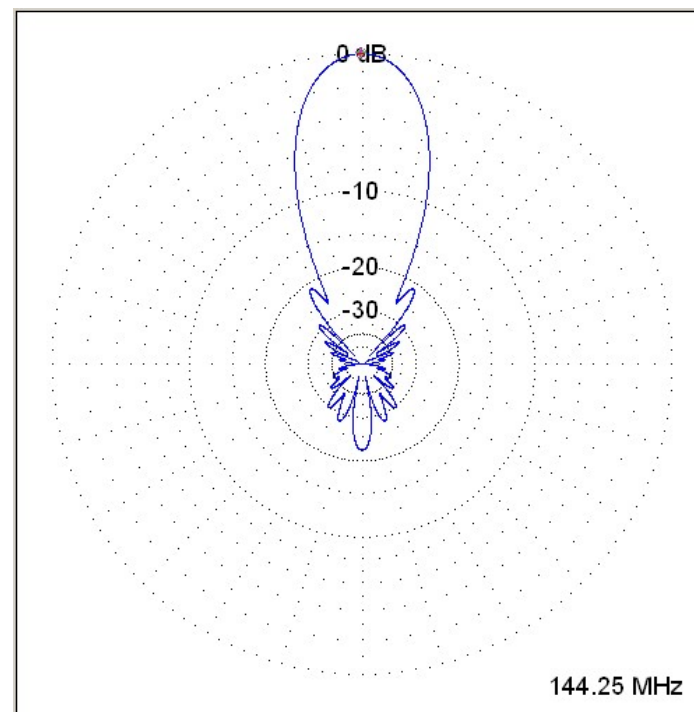
Wideband Scanning?

AOR 8200mk III	£470
MyDel Discone antenna	£73
Total cost	£543

GHz Bands and Contesting

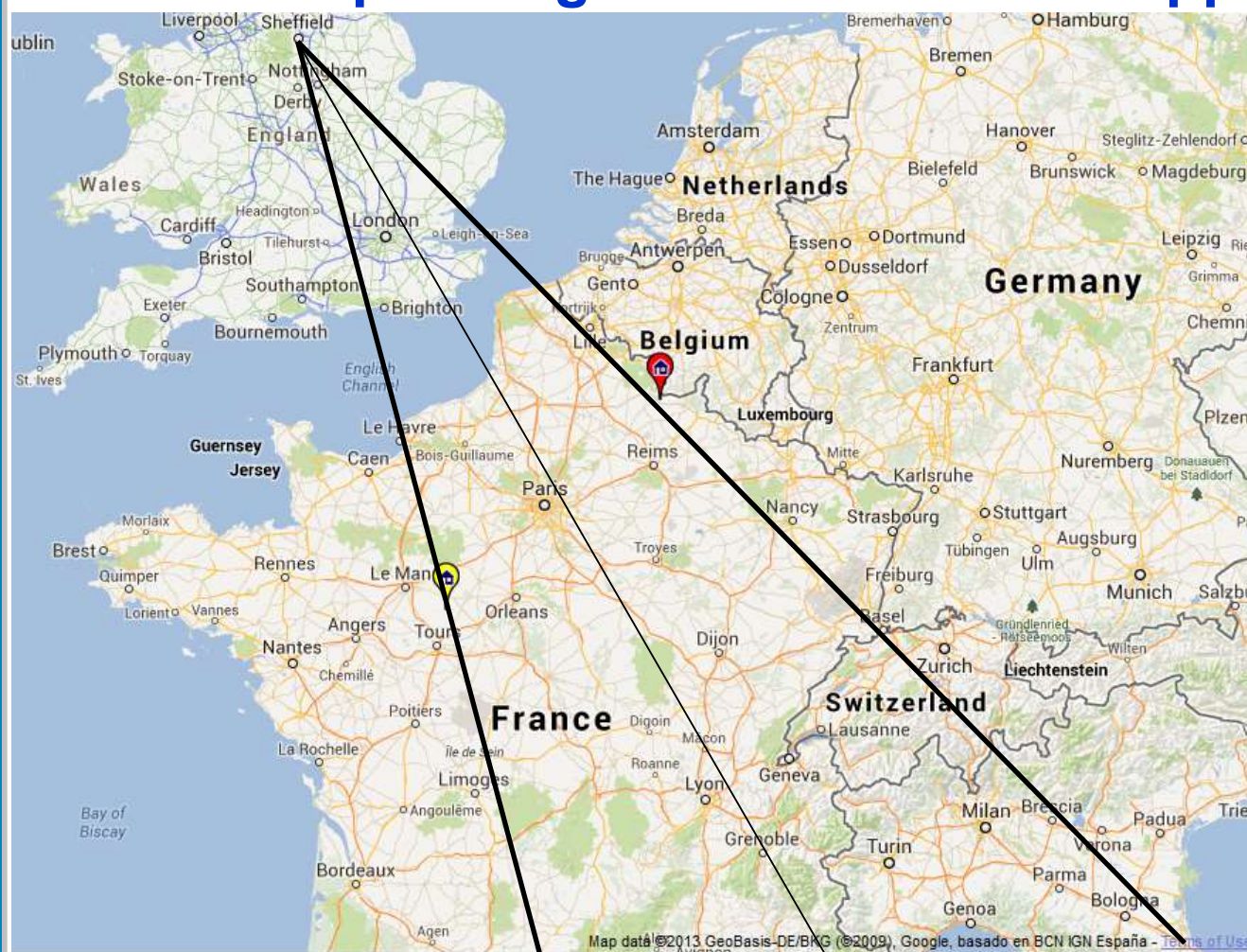
Contest operating – The VHF approach

- **VHF and below contests**
 - Big station, high EIRP, call CQ towards main activity centres.
 - Maybe use a second wide beam RX antenna and multiple receivers
 - “Search and pounce”



GHz Bands and Contesting

Contest operating – The Microwaver approach



Antenna beamwidth

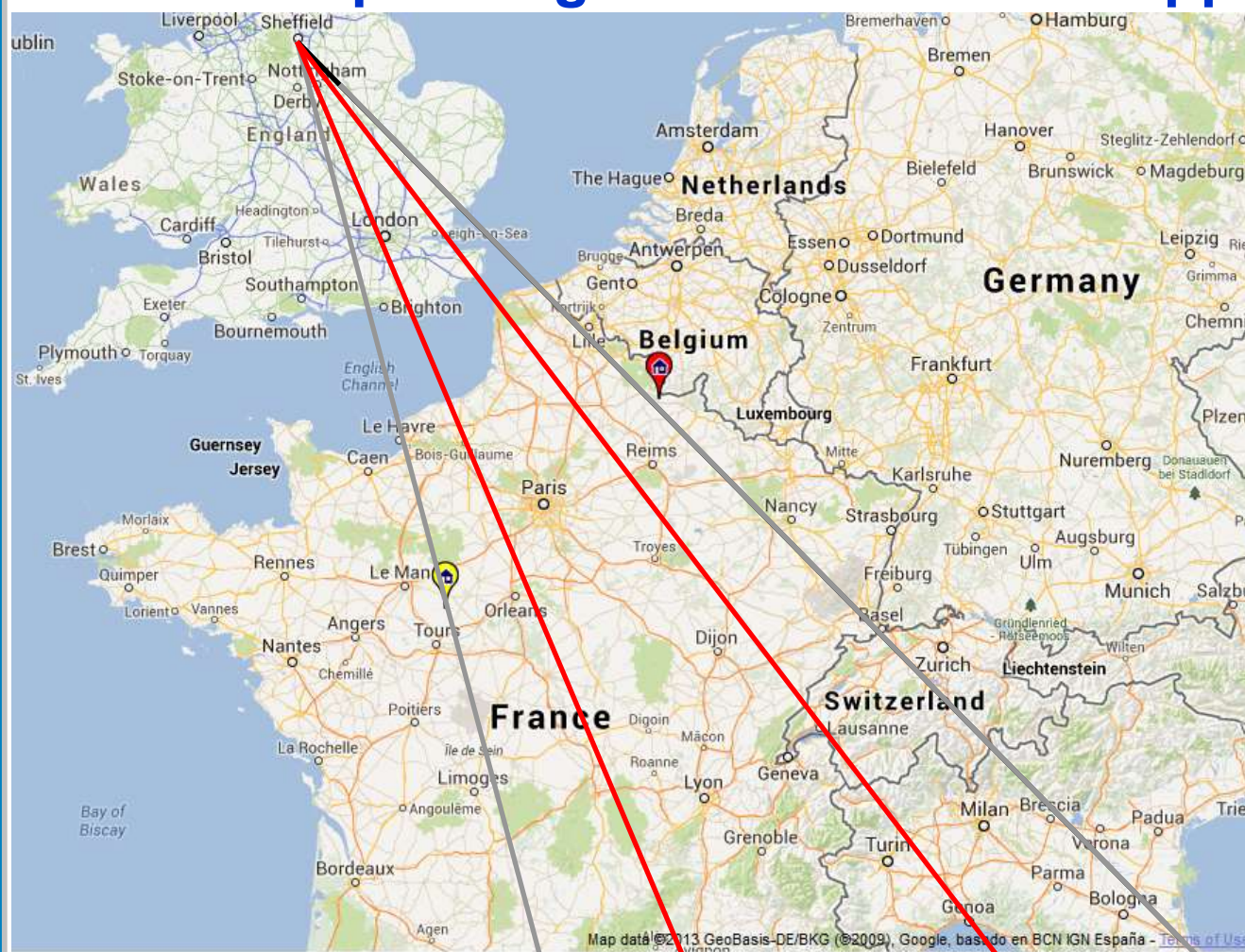
17 el Yu7ef for 2m
26 degrees beamwidth

Wide area coverage, -
makes sense to call
CQ and search

From the North, your
cover most of UK and
the continent on 4
beam headings

GHz Bands and Contesting

Contest operating – The Microwaver approach



Antenna beamwidth

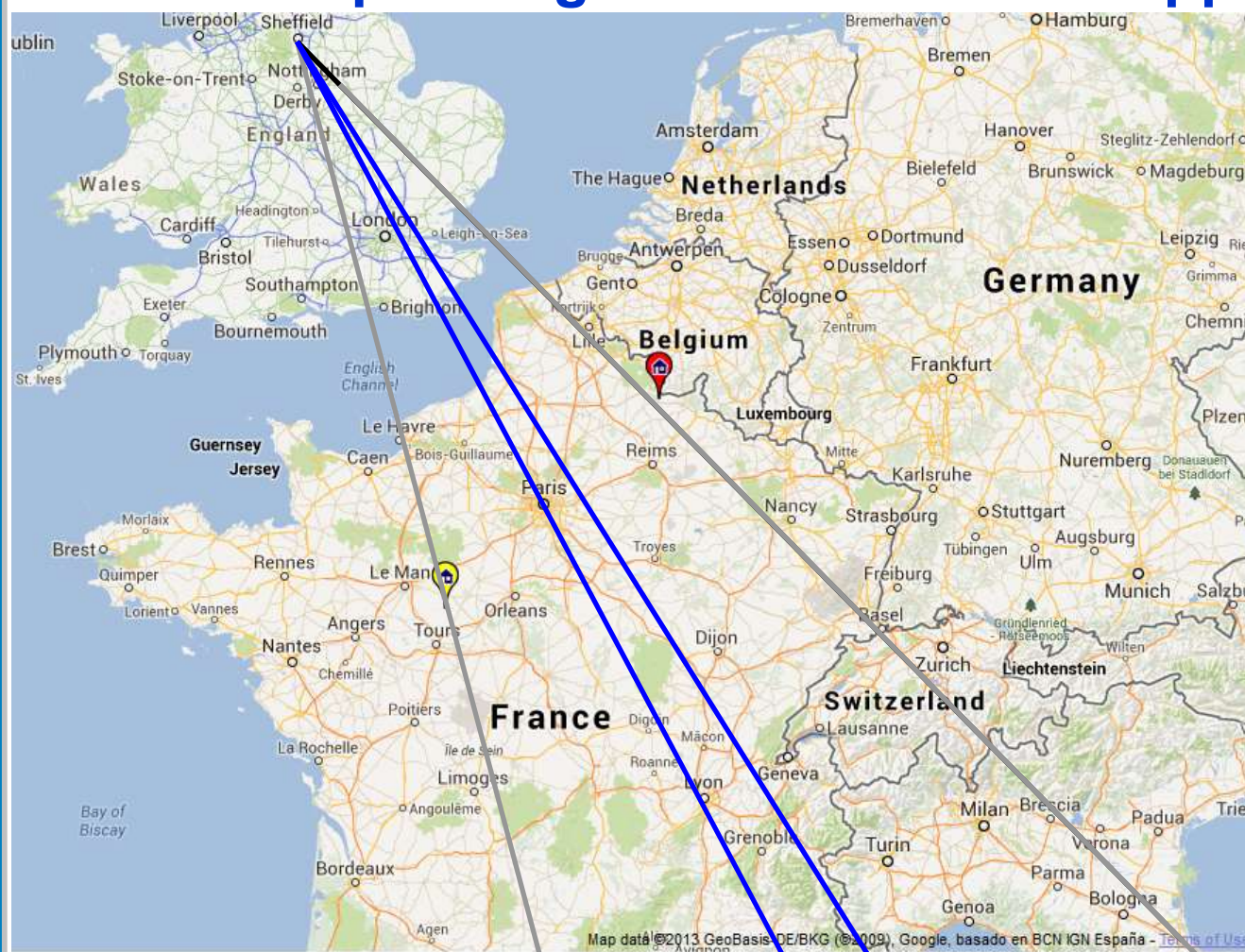
17 el Yu7ef for 2m
26 degrees beamwidth

55element Tonna for
23cms 13 degrees

Still a reasonable area
coverage but you need
to make more calls
with smaller direction
increments – more
time consuming

GHz Bands and Contesting

Contest operating – The Microwaver approach



Antenna beamwidth

17 el Yu7ef for 2m
26 degrees beamwidth

60cm dish for 10GHz
3.3 degrees

Very limited area
coverage. CQs don't
really work!

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Contest operating – The Microwaver approach

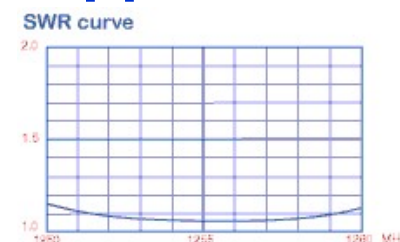
• VHF and below contests

- Big station, high EIRP, call CQ towards main activity centres.
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- “Search and pounce”

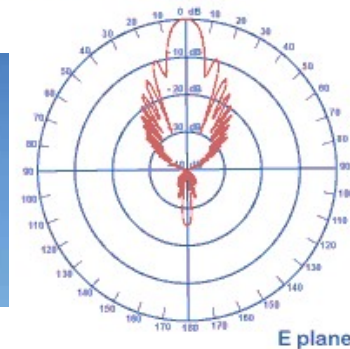
• Microwave contests

- Very sharp antennas,
 - <7 degrees for Yagis, <4 degrees for a dish.
 - calling CQ and search and pounce are less effective and ineffective on high bands.
- Skeds are allowed
- ON4KST internet chat used to “call CQ” and set up skeds in real time
- Call CQ for talkback on Lower bands 144.175
 - Requires a secondary big 144MHz station

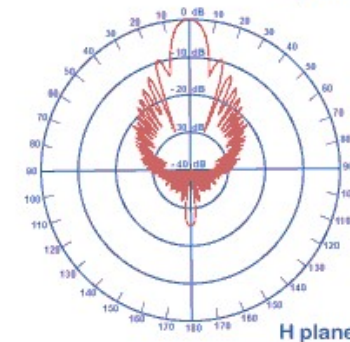
55 el Tonna



Radiation patterns



E plane



H plane

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Contest operating – The Microwaver approach

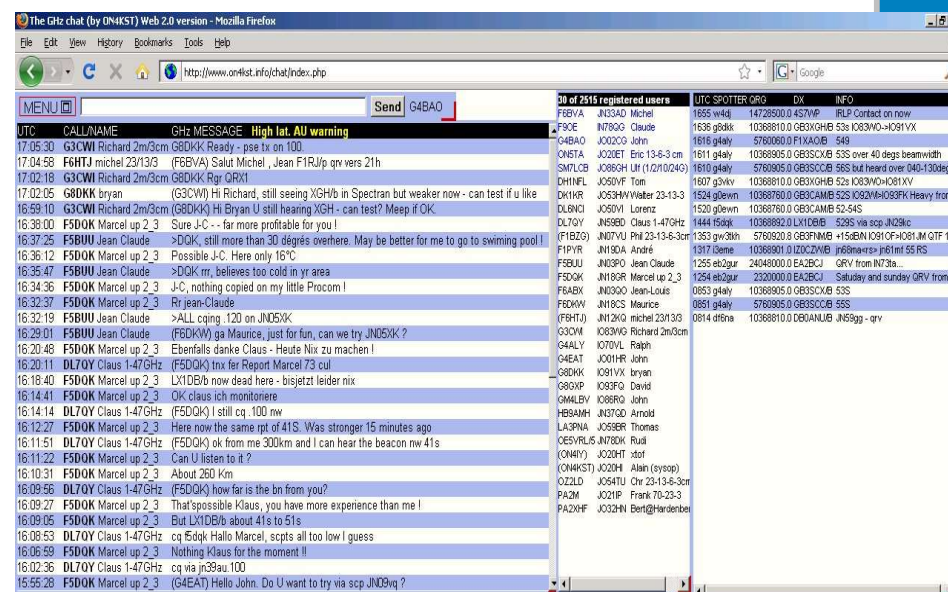
• Searching

- Use an SDR to look at the band
- Watch activity on ON4KST.info
 - See who is operational and where they are
 - Pick off the “low lying fruit” as soon as you see them
 - they may be only on for an hour or so
- Announce your band, frequency, bearing on KST
 - run a “CW CQ loop”

GHz Bands and Contesting

Contest operating – The Microwaver approach

- **Making a QSO using KST**
 - “meep” the stations you want to work and ask politely for sked
 - Be patient, they may have a queue
 - Above 2.3GHz ask if they are “locked” or free running
 - Calculate their bearing and point
 - Agree who will call first
 - Give a long call
 - frequent breaks to allow them to find you and peak up
 - or wait until they give you a “got U” on KST
 - or ask if you are received
 - Exchange QSO details as normal



GHz Bands and Contesting

Contest operating – The Microwaver approach

- **Talkback**

- The efficient use of talkback doesn't come naturally to some.
- In the days before KST when it was all on 2m then there could be a bit of a free for all on 144.175 at times.
- With ON4KST its possible to have lots of separate conversations at once.
 - tools such as KST2ME help to filter out your conversations
- You can “talk” to several stations at once, but
 - It's bad etiquette to try and set up large numbers of immediate skeds and expect stations to wait patiently while you finish a previous QSO.
- Don't get frustrated when requests for a sched on KST seem to be ignored
 - it might be because the other station is in QSO or has simply missed your request. Try again later.
- Good keyboard skills are important now
- KST requires operating indoors or in a shaded environment to see the screen.

GHz Bands and Contesting

Contest operating – The Microwaver approach

- **Rotators / antenna pointing**

- Accurate rotor setting is needed for the higher bands.
- Digital bearing readout and settability to +/- 1 degree are important
- Computer control – type in locator and the antenna turns
- Choose a rotator carefully, many have very non-linear readouts.
 - Variable speed rotor helps
 - 180 degrees in 20 seconds or less
 - whilst retaining accuracy
 - and without overstressing the antennas or rotator.

GHz Bands and Contesting

Contest operating – The Microwaver approach

- **Aircraft Scatter**

- Much of the DX worked on 23/13cm is by aircraft scatter
- Tools such as AirScout and Planeplotter are essential to get good results.
- Go to G3XDY's talk about Air Scout on Sunday talking to get the full story!

GHz Bands and Contesting

Contest operating – The Microwaver approach

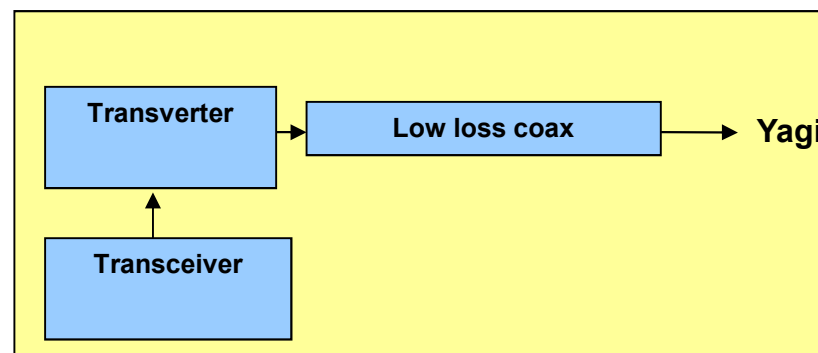
- **Technical skills**

- To reduce cost, turn your hand to modifying or building your own.
- System design is where you can differentiate from other stations.
- Use technical skills to build a station optimised for contest working
 - hard to do with entirely off the shelf kit.
- Every aspect of the station needs careful optimisation
 - just buying the lowest NF preamp, highest power PA and lowest loss coax does not mean that you will win
- system integration is the key
- Site and demography play a very large role too.

GHz Bands and Contesting

#4 - But its Too Technical for me!

- **Beginners setups**
- **23cms and 13cms**
 - JUST the same as 2m as far as equipment is concerned.
 - A transceiver, (a transverter) and a Yagi



Key technology drivers – history

PCBs and Microstrip

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

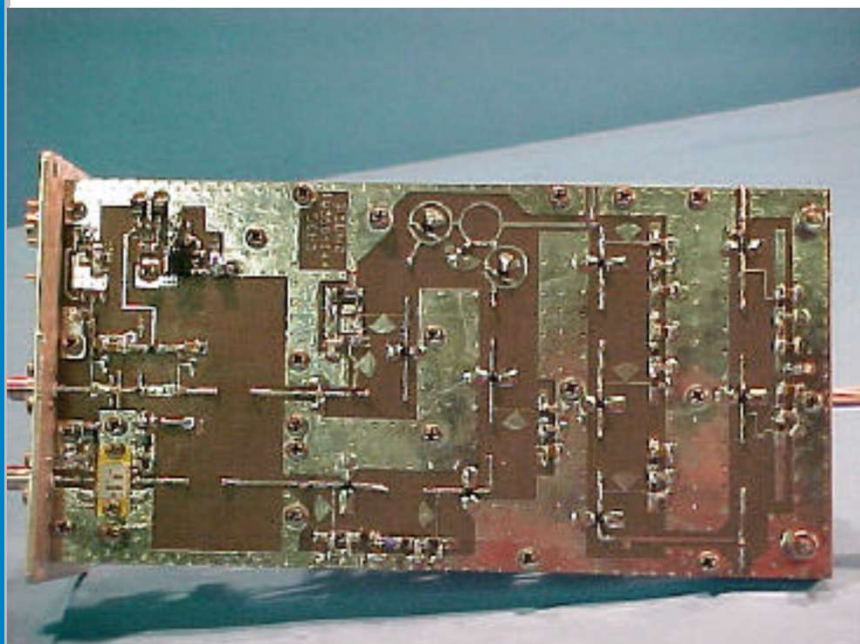


Key technology drivers – history

And now

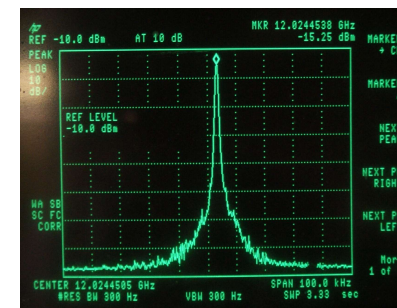
Not **black boxes**, but “silver boxes”

- DB6NT transverter range
- DEMI – Down East Microwave



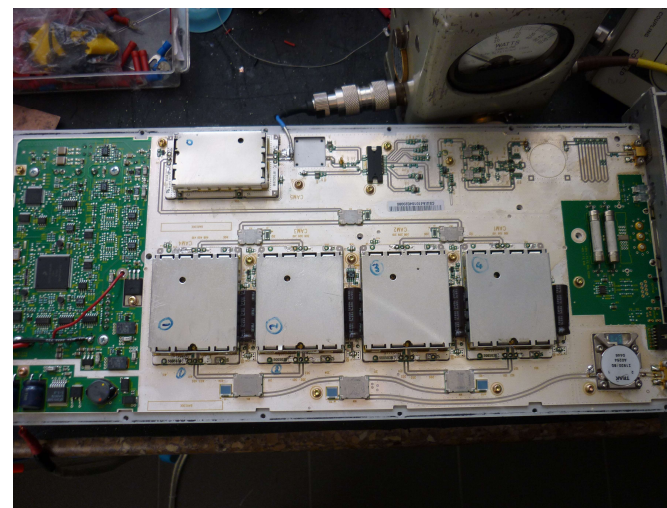
Key Technology Drivers

- **Narrowband!!**
- Low phase noise references
 - G4DDK Butler Oscillator/Multiplier
 - G8ACE OCXO
- Frequency locking
 - Many cheap surplus 10MHz sources available
 - OCXO, GPSDO, Rubidium
- Reflock board
 - Luis Cupido CT1DMK
- “Reverse DDS”
 - Andy Talbot G4JNT, John Hazell G8ACE
- GW4DGU “Plug and Play”
 - 10GHz transverter boards



Key Technology Drivers

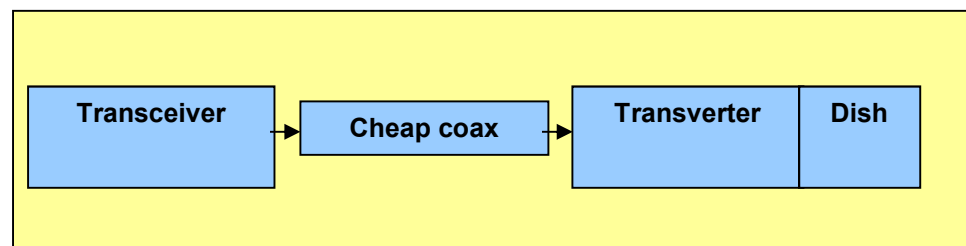
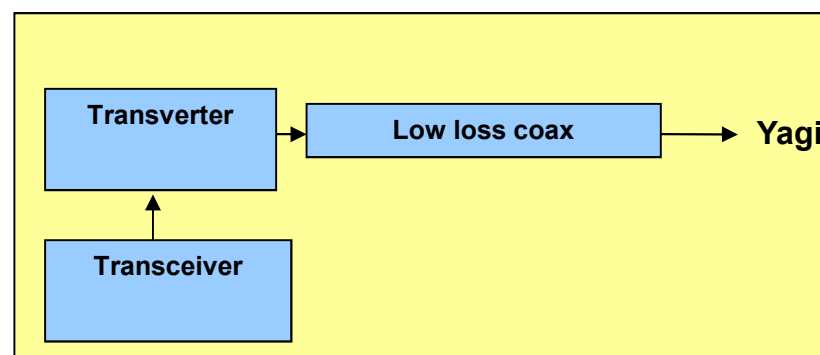
- Low noise Amplifier kits
 - G4DDK VLNA2 sub-£50 kit
 - < 0.3dB noise figure on 1296MHz
 - < 0.3dB noise figure on 2320MHz
 - < 0.45dB noise figure on 3400MHz
- Surplus Solid State PAs
 - Andrew ILAM/IPAM
 - 200 Watts+ on 2320MHz
 - Ionica PA module
 - 18W on 3400MHz
 - Ferranti “TWT replacement”
 - 12 Watts on 5760MHz



GHz Bands and Contesting

#4 - But its Too Technical for me!

- **Beginners setups**
- **23cms and 13cms**
 - JUST the same as 2m as far as equipment is concerned.
 - A transceiver, (a transverter) and a Yagi
- **Higher bands**
 - Difference is that transverter needs to be close to the antenna.
 - Waterproof box and power feed
 - Small dish antenna

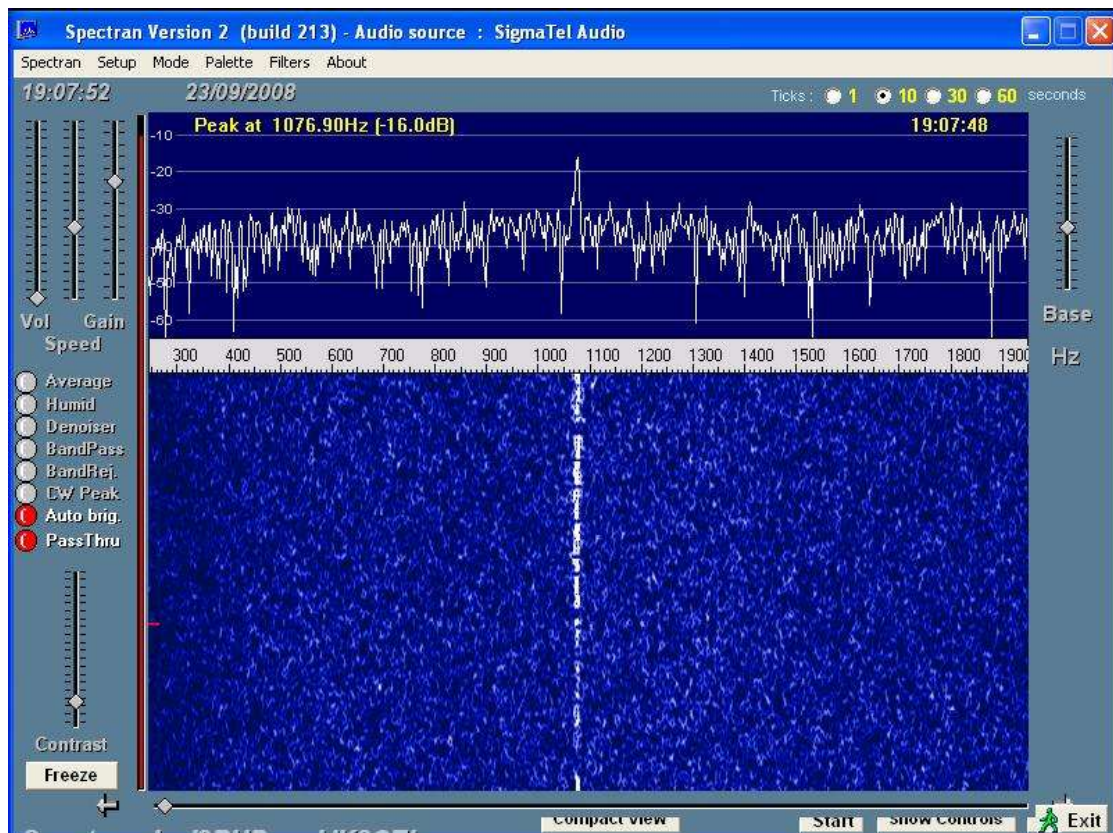


Propagation

- Optical
 - 24/7
 - Line of sight – hilltop to hilltop
- Tropospheric enhancement and Ducting
 - Weather-dependent
 - Enhanced range up to 2500km
 - BIG ADVANTAGE NEAR THE COAST
- Tropo Scatter
 - 24/7
 - Over the horizon up to 500km
- Rain Scatter
 - Weather-dependent
 - Over the horizon up to 800km
- Aircraft Scatter
 - 24/7
 - Over the horizon up to 800km

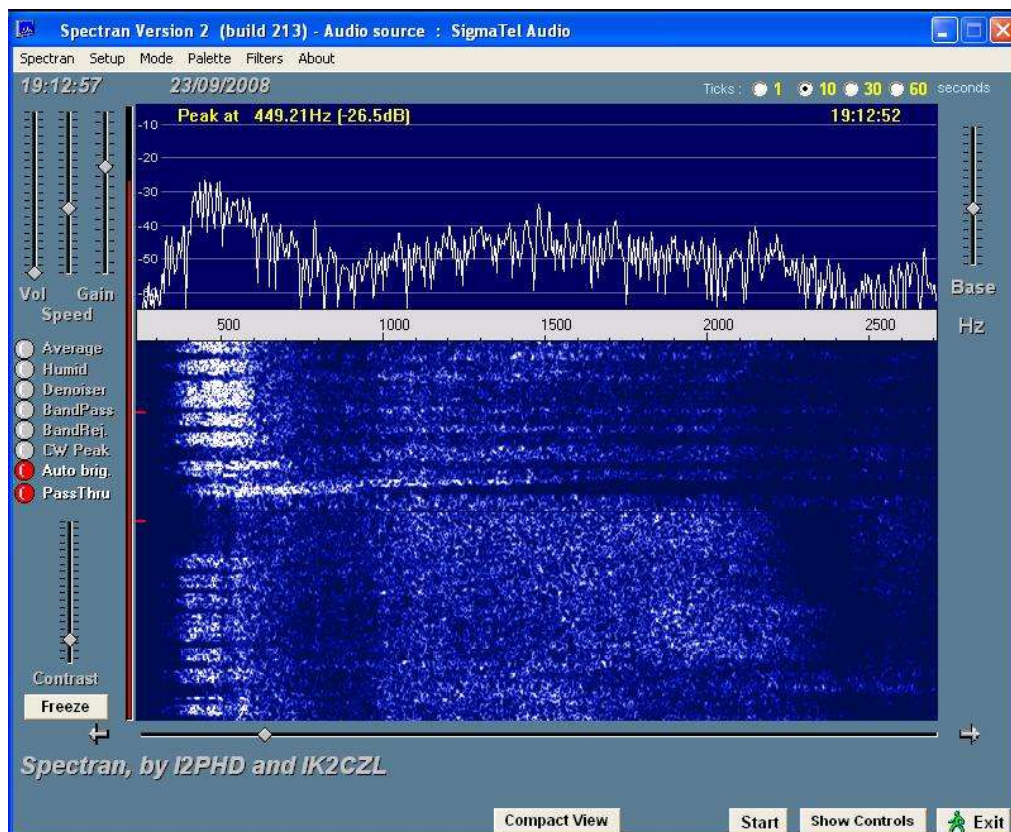


Tropo



LY2WR on 23cms via Tropo

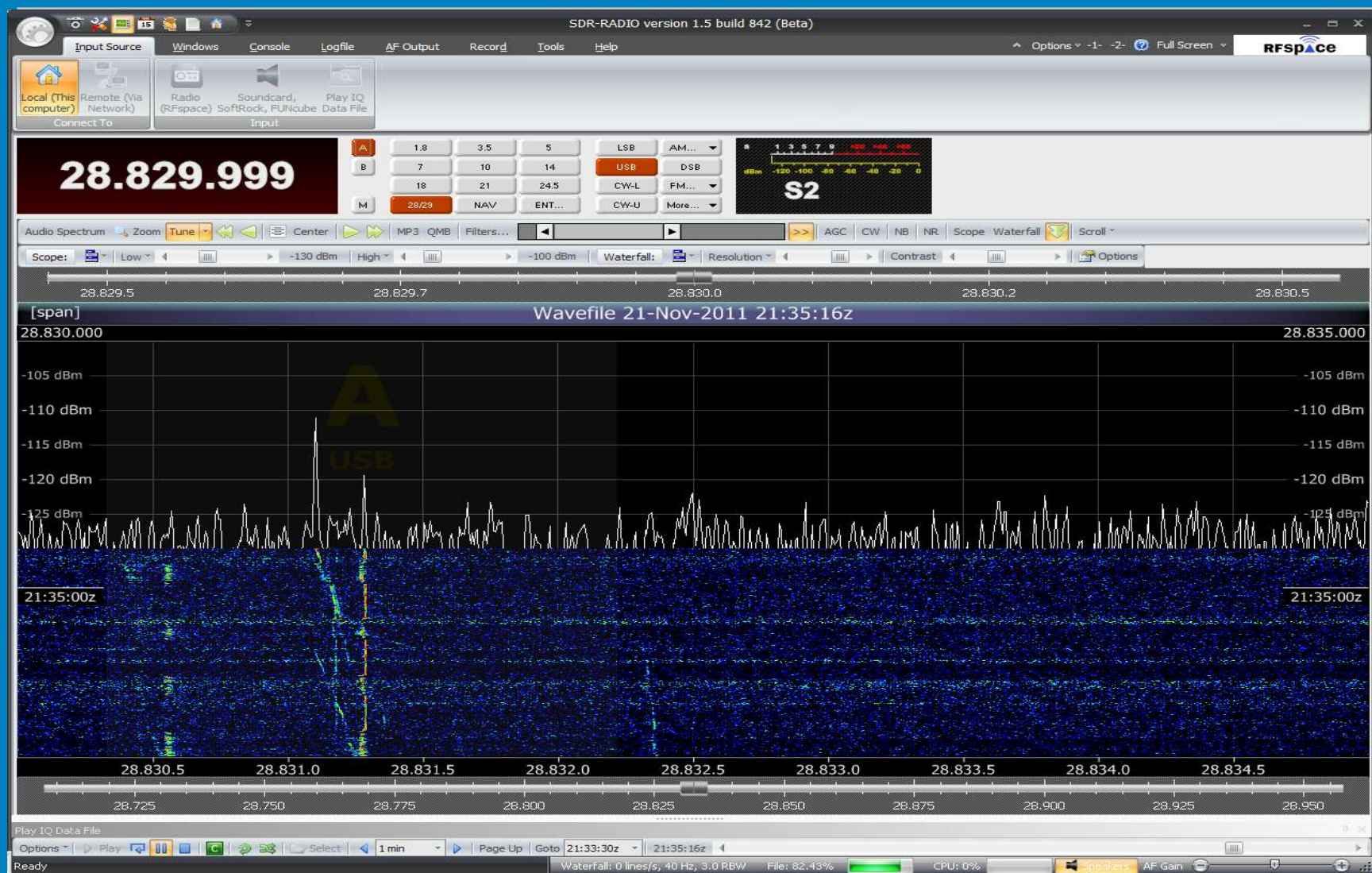




Rain scatter



Aircraft Scatter



Things that help

• Low band talkback

– 144.175 is popular

• All these things should only be used for co-ordination, not for confirming QSO details!

• ON4KST Chat

– www.on4kst.info

• Know your frequency

• know the beam heading

• Local beacons

• GB3CAM 3cm & 24GHz

• GB3PS 23cms

• GB3ANT 13cm

• www.beaconspot.eu

The GHz chat (by ON4KST) Web 2.0 version - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.on4kst.info/chat/index.php

Google

MENU Send G4BAO

UTC	CALL/NAME	GHz MESSAGE	High lat. AU warning
17:05:30	G3CWI Richard 2m/3cm	G8DKK Ready - pse tx on 100.	
17:04:58	F6HTJ michel 23/13/3	(F6BVA) Salut Michel , Jean F1RJ/p qrv vers 21h	
17:02:18	G3CWI Richard 2m/3cm	G8DKK Rgr QRX1	
17:02:05	G8DKK bryan	(G3CWI) Hi Richard, still seeing XGH/b in Spectran but weaker now - can test if u like	
16:59:10	G3CWI Richard 2m/3cm	(G8DKK) Hi Bryan U still hearing XGH - can test? Meep if OK.	
16:38:00	F5DOK Marcel up 2_3	Sure J-C -- far more profitable for you !	
16:37:25	F5BUU Jean Claude	>DQK, still more than 30 degrés overhere. May be better for me to go to swimming pool !	
16:36:12	F5DOK Marcel up 2_3	Possible J-C. Here only 16°C	
16:35:47	F5BUU Jean Claude	>DQK rrr, believes too cold in yr area	
16:34:36	F5DOK Marcel up 2_3	J-C, nothing copied on my little Procom !	
16:32:37	F5DOK Marcel up 2_3	Rr jean-Claude	
16:32:19	F5BUU Jean Claude	>ALL cqng .120 on JN05XK	
16:29:01	F5BUU Jean Claude	(F6DKW) ga Maurice, just for fun, can we try JN05XK ?	
16:20:48	F5DOK Marcel up 2_3	Ebenfalls danke Claus - Heute Nix zu machen !	
16:20:11	DL7QY Claus 1-47GHz	(F5DQK) tnx fer Report Marcel 73 cul	
16:18:40	F5DOK Marcel up 2_3	LX1DB/b now dead here - bisjetzt leider nix	
16:14:41	F5DOK Marcel up 2_3	OK claus ich monitoriere	
16:14:14	DL7QY Claus 1-47GHz	(F5DQK) I still cq .100 nw	
16:12:27	F5DOK Marcel up 2_3	Here now the same rpt of 41S. Was stronger 15 minutes ago	
16:11:51	DL7QY Claus 1-47GHz	(F5DQK) ok from me 300km and I can hear the beacon nw 41s	
16:11:22	F5DOK Marcel up 2_3	Can U listen to it ?	
16:10:31	F5DOK Marcel up 2_3	About 260 Km	
16:09:56	DL7QY Claus 1-47GHz	(F5DQK) how far is the bn from you?	
16:09:27	F5DOK Marcel up 2_3	That'spossible Klaus, you have more experience than me !	
16:09:05	F5DOK Marcel up 2_3	But LX1DB/b about 41s to 51s	
16:08:53	DL7QY Claus 1-47GHz	cq f5dkg Hallo Marcel, scpts all too low I guess	
16:06:59	F5DOK Marcel up 2_3	Nothing Klaus for the moment !!	
16:02:36	DL7QY Claus 1-47GHz	cq via jn39au.100	
15:55:28	F5DOK Marcel up 2_3	(G4EAT) Hello John. Do U want to try via scp JN09vq ?	

30 of 2515 registered users			UTC SPOTTER QRG	DX	INFO
F6BVA	JN33AD	Michel	1655 w4dj	14728500.0 4S7VWP	IRLP Contact on now
F9OE	IN78QG	Claude	1636 g8dkk	10368810.0 GB3XGH/B	53s IO83WO->IO91VX
G4BAO	JO02CG	John	1616 g4aly	5760060.0 F1XAO/B	549
ONSTA	JO20ET	Eric 13-6-3 cm	1611 g4aly	10368905.0 GB3SCX/B	53S over 40 degs beamwidth
SM7LCB	JO86GH	Ulf (1/2/10/24G)	1610 g4aly	5760905.0 GB3SCC/B	55S but heard over 040-130deg
DH1NFI	JO50VF	Tom	1607 g3vkv	10368810.0 GB3XGH/B	52s IO83WO>IO81XV
DK1KR	JO53HW	Walter 23-13-3	1524 g0ewn	10368760.0 GB3CAMB	52S IO92VM>IO93FK Heavy fronts
DL6NCI	JO50VI	Lorenz	1520 g0ewn	10368760.0 GB3CAMB	52-54S
DL7QY	JN59BD	Claus 1-47GHz	1444 f5dkg	10368892.0 LX1DB/B	529S via scp JN29kc
(F1BZG)	JN07VU	Phil 23-13-6-3cm	1353 gw3tkh	5760920.8 GB3FNM/B	+15dBm IO91OF>IO61JM QTF 10:
F1PYR	JN19DA	André	1317 i3eme	10368901.0 IZ0CZV/B	jn68mas> jn61mf 55 RS
F5BUU	JN03PO	Jean Claude	1255 eb2gur	24048000.0 EA2BCJ	QRV from IN73ta...
F5DQK	JN18GR	Marcel up 2_3	1254 eb2gur	2320000.0 EA2BCJ	Saturday and sunday GRV from IL
F6ABX	JN03GO	Jean-Louis	0853 g4aly	10368905.0 GB3SCX/B	53S
F6DKW	JN18CS	Maurice	0851 g4aly	5760905.0 GB3SCC/B	55S
(F6HTJ)	JN12KQ	michel 23/13/3	0814 df6na	10368810.0 DB0ANU/B	JN59gg - qrv
G3CWI	IO83WG	Richard 2m/3cm			
G4ALY	IO70VL	Ralph			
G4EAT	JO01HR	John			
G8DKK	IO91VX	bryan			
G8GXP	IO93FQ	David			
GM4LBV	IO86RQ	John			
HB9AMH	JN37GD	Arnold			
LA3PNA	JO59BR	Thomas			
OESVRL/5	JN78DK	Rudi			
(ON4IY)	JO20HT	xtof			
(ON4KST)	JO20HI	Alain (sysop)			
OZ2LD	JO54TU	Chr 23-13-6-3cm			
PA2M	JO21IP	Frank 70-23-3			
PA2XHF	JO32HN	Bert@Hardenber			

Acknowledgements and References

This presentation and links to additional information are available on

www.g4bao.com

UK Microwave Group

www.microwavers.org

Beaconspot

www.beaconspot.eu

G4HJW's site

<http://www.g4hjlw.metahusky.net>

RadCom August 2007

- *"Getting started on 3cm"*



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