

COULSDON AMATEUR TRANSMITTING SOCIETY  
**G4FUR**  **M1FUR**  
**CATS WHISPERS**



Affiliated to the RSGB

**October 2009**

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**CATS Committee**

Chairman: Steve Conway, G7SYO  
Secretary: Andy Jackson, G8JAC  
Treasurer: Derek Hands, G1PGS  
Members: Steve Beal, G3WZK  
Stuart Barber, G6CJR  
Dennis Noe, M0NDJ  
Frank Emery, G3ZMF

**CATS Whispers Editor:** Steve Beal, G3WZK  
email address for contributions: [newsletter@catsradio.org](mailto:newsletter@catsradio.org)

**Regular Society Meetings**

These are held on the second Monday in each month at:  
St. Swithun's Church Hall, Grovelands Road, Purley, Surrey, CR8 4LA at 20:00 to 22:00

**Society Nets**

1st Saturday of Month - 17:15 - Crescenta Valley / CATS Net on Echolink  
Normally via MB7IPL node on 145.2875 MHz  
Sunday mornings - 11:00 - Call on 145.2875MHz.  
Sunday evenings - 17:00 - Call on 3.700 MHz ± QRM  
Wednesday evenings - 21:00 - Call on 70.425 MHz

**CATS Website**

[www.catsradio.org](http://www.catsradio.org)

**Email**

[enquiries@catsradio.org](mailto:enquiries@catsradio.org)

**Forthcoming Meetings**

Monday 12<sup>th</sup> Oct "Effective small antennas - the loop leads the way, Goubau explains why." Talk by Professor Mike Underhill, G3LHZ  
Monday 9<sup>th</sup> Nov Annual CATS Quiz with question master Frank, G3ZMF  
Monday 14<sup>th</sup> Dec AGM



CATS is twinned with the Crescenta Valley Radio Club  
Glendale California USA [www.qsl.net/cvrc](http://www.qsl.net/cvrc)

## September Meeting Report

This was billed as a “Classic Radios Show And Tell” evening and the idea for it was first conceived by Adam G7CRQ and Frank G3ZMF in December 2008. Part of their idea was to get people to dig out their old gear and put it back on the air. However, this evening we simply asked members to bring along an old (1980 or earlier) piece of radio equipment and be prepared to demonstrate it. Six members - plus one potential member - did just that.

Colin, G3YCR, brought along an HRO receiver and set of plug-in coil packs that he had acquired from a silent key sale in 2006. The radio came with a fascinating book of documentation including the set’s history and calibration charts. The radio had first been used by the RAF in Singapore in 1944. Both it, and the RAF PSU that Colin was using to power it, were fully tropicalised and in full working order.

Colin’s receiver was tuned to the CW section of 80 metres and, thanks to the crystal phasing control, provided true “single signal” reception that was a joy to listen to.



The HRO (top) with associated PSU of Colin, G3YCR

Non-member John, 2E0MOC, had kindly brought along a completed Heathkit HW8 QRP CW transceiver kit, with a selection of Morse keys. The set was not demonstrated as it had a faulty variable capacitor – but your newsletter editor once made one of these sets and can testify to the fun that they can provide. They cover 80m, 40m, 20 m and 15m and typically

produce 3 to 3.5 watts output. They have a direct conversion receiver.



The HW8 transceiver and Morse Keys of John, 2E0MOC

Next along was Mike, M1CCF, who had brought three rigs with him including a small Trio 2 metre transceiver, a Yaesu FT707 and a somewhat older 62-set.

Made by Pye, the Wireless Set No 62 is a low power high frequency transceiver designed to operate from a 12 volt DC supply. It was intended for both military and civilian purposes and could be used in both mobile and fixed environments in the range of 1.6 to 10 MHz.

Weighing in at 13.5 kg (30 lbs), the set had a maximum output power of 2 watts. Mike’s version was complete with original whip antenna, headphones and microphone.



Mike, M1CCF, and his 62 set



The 2m Trio transceiver of Mike, M1CCF

Ken, G3DJK, brought along a 10 metre transmitter that he constructed in 1947 using an 1132 chassis that he had acquired in Burma. The range of the 1132 was only 20 miles but Ken had heard that there were stations from India (VU) Australia (VK) and Honk Kong (VS now VR) just waiting to be worked and was determined to get a slice of the action by rebuilding the rig for 28 MHz.



Ken, G3DJK with his homebrew 10 metre transmitter. The outboard VFO is on the left.

Ken's rig used the 5<sup>th</sup> harmonic of a crystal-controlled oscillator running at around 5.7 MHz to achieve an output in the range of 28.5 MHz.

Also displayed by Ken was an outboard VFO for use with this transmitter. Thank you Ken – and roll on the next peak in the sunspot cycle so that we can all again enjoy the full potential of 10 metres!

Frank, G3ZMF, brought with him a large range of gear. He had several ex-PMR rigs including Cambridge, Westminster, Europa, Olympic and Reporter (all made by Pye) and a Corsor Commando CC701. He also brought in a KW2000A and various sundry items such as field strength meters.



The KW2000A belonging to Frank, G3ZMF



The inside of the KW2000A belonging to Frank, G3ZMF

Also from the KW factory in Dartford, Kent, was a KW77 receiver brought in by Mike G8AAI on behalf of Tom, G4DFA. This set had originally belonged to G2BCI and although it had apparently once been damaged by damp, it is now in full working condition and of pristine

appearance. The rig dates back to 1964 and was a companion to the Viceroy transmitter, also made by KW.



The KW77 belonging to Tom, G4DFA

Mike himself had also brought in a restored WW2 APS13 radar set. The set worked in the range 400 to 420 MHz and was designed to provide warning of an enemy approaching from the rear – but only once they were within 700 metres (800 yards) of their target!

It is also reported that versions of the set were used as an altitude detector in an atom bomb, A total of 4 sets were apparently set to operate at a height of about 1600 feet. To stop detonation at an incorrect altitude the outputs of the four radios were compared until two agreed with the pre-set altitude. The rest, as they say, is history but fortunately for CATS, Mike did not bring any other atom bomb components with him to the meeting!

Mike's version of the radar was in working order and was accompanied by the TS184A/P tester to prove it. Both sets entered service in 1944.

CATS Secretary Andy, G8JAC, is a keen member of The Vintage and Military Amateur Radio Society (VMARS – see <http://www.vmars.org.uk/>) and had brought in two fine military receivers to illustrate this side of the hobby.

Designed by the Collins company, the R390A design dates back to 1951 and was constructed by Motorola. The radio operates as a double conversion superhet from 500 kHz to 8 MHz, while from 8 MHz to 32 MHz it uses triple conversion techniques. It has a total of 31 thermionic valves, with 4 mechanical filters and 2 crystal filters to provide an impressive set of bandwidth options. Lacking a synthesiser it used instead a large bank of quartz crystals, with permeability tuned signal and variable oscillator tuning circuits. A very linear VFO

permitted frequency setting/readout to be achieved with mechanical digital readout.



Andy removes internal screening covers from his R390A

Extremely complex, Andy had done a fine job or restoring it – including extensive replacement of capacitors – a well-known potential fault of the set being that certain capacitors can effectively destroy the mechanical filters if they go short circuit. Andy's example was from 1956 and was fully operational for the meeting.



The R390A of Andy, G8JAC

Andy also brought with him the R390A's successor – the smaller and more portable R392. The 392 also used valves – but had been designed to run with a HT rail of only 24 volts – thus permitting direct battery option in the M38 jeep that it often saw service in with the companion transmitter, the T195 100 watt

AM/CW Tx. Apparently, Andy has put the T195 on his Christmas present list !



The R392 of Andy, G8JAC

Both R390A and R392 are from the pre-SSB era but, despite this they remained in service for many years including during the Apollo moon landing programme and in the first Gulf war where they coped much better with Iraqi jamming than more modern transistorised receivers.

Steve, G3WZK, took three items to this event. Firstly, a Bush DAC90 octal valve domestic radio. The set was launched 1946 at a price of £11 11s 0d. Steve had replaced the smoothing electrolytic capacitors but admitted that more work was required although it does work okay.

He bought the set from an antique shop in Horley in 2004 and it was significant to Steve because it was on a similar set in 1963 that he experienced breakthrough from local amateurs on 160m and 80m, kicking off his interest in the hobby.



Bush DAC90 domestic radio from the G3WZK collection

The second item from Steve was a Dynatron TP14 germanium transistor portable radio from the early 1960s. He received it recently as a present from his brother-in-law – who had inherited it as family heirloom. The set is in working condition and the semiconductor line-up includes an OC44, 2 x OC45, OC78D and 2 x OC78. A classic set.

The third item from Steve was a homebrew Top Band and 80m valve transmitter, constructed by Steve when first licensed, permitting him to have his first ever QSO on 30<sup>th</sup> November 1967 with G3SJE. The 5763 PA stage is rated at 10 watts input, that being the power limit on 160 metres at the time of construction. The set's most recent QSO was on Christmas Day 2008, in the CATS AM Christmas net. This rig performed flawlessly for the first hour of the meeting – but then a suspicious odour soon followed by smoke emanated from its interior. A heartbroken Steve said, "from the smell, it seems the mains transformer may have given out after nearly 42 years' service. It's a long time, so I suppose I mustn't grumble!"

However, when Steve got the transmitter home and tested it the next day, it appeared still to be in working order. "Something has caused the insulation on the green 6.3 volt heater wires to melt (see photo)," he said. "These wires will need to be replaced of course, but the Tx itself is okay and still produces a healthy amount of RF into a dummy load. Here's to the next 42 years!"



Melted heater wires (green) on G3WZK's vintage homebrew Top Band transmitter

## **Membership Matters**

**Rubbing House:** Following the CATS annual dinner that was held last January at the Woolpack in Banstead, the CATS committee have decided that the 2010 event will be held on 11<sup>th</sup> January in the Rubbing House on Epsom Downs racecourse. The nearby Derby

Arms was also considered, but the Rubbing House won out on grounds of value for money and service. The CATS Secretary will email all members to make a firm booking - but please feel free to contact him in advance if you wish. For more information on the venue, visit:

<http://www.rubbinghouse.com/home.html>

## **CATS October Meeting**

"Effective small antennas - the loop leads the way, Goubau explains why" will be a talk by Professor Mike Underhill, G3LHZ. As Mike is an acknowledged technical expert in this field the evening should be very interesting – particularly for those of us with small or no gardens.

## **CATS November Meeting**

This will be the CATS annual quiz, led again this year by Frank, G3ZMF. The rounds are expected to include questions on History, Sport, "Ologies" and General Knowledge with a musical section provided by G8JAC. So get swotting everyone!

Other clubs invited to participate include Crawley ARC, Dorking & DRS, Reigate ATS, Surrey RCC, Sutton and Cheam RS and Wimbledon & DRS.

## **CATS December Meeting** **Advance Notice Of AGM**

**Annual General Meeting Of The Society**  
In accordance with the rules of the Society, notice is hereby given that the Annual General Meeting of the Coulsdon Amateur Transmitting Society will be held on Monday 14th December 2009 at St. Swithun's Church Hall, Grovelands Road, Purley, Surrey CR8 4LA, commencing at 20:15 hours.

## **Letter from W6 land**

Mark, W6MW, writes, "The monthly Transponder Net took place on Saturday, October 3rd on the WB6ZTY Repeater in

Glendale, California and the MB7IPL Node in Purley, Surrey.

"We had mild turnout probably due to weather and a busy fall weekend. Joining the net in the US were: AD6IZ (Larry), KE6MMU (Leah) and W6MW/8 (Mark) in Columbus. UK participants included: G4CDY (Terry), G8JAC (Andy) and 2E0JXN (Paul).

"We learnt that Paul, 2E0JXN and Zoe (XYL) have acquired a border collie. Leah (KE6MMU) advised that the breed is generally very active so we can guess that Paul will now be being walked twice nightly from now on. Congratulations to Paul & Zoe.

"Mark, W6MW/8 joined in from Columbus, OH. He expects this to be his last Net from that location for the time being. He is returning to California soon and has been keeping busy with packing of his gatherings over the last 26 months. He hasn't seen his home since August 4, 2007 and the "Station Fire" burned within 3.5 miles of it. He has to see if there are any problems caused by the accumulation of ash from the fire as well as general wear and tear on the place.

"The Net was short and sweet because of the number of check-ins. However, we are all good friends now and can quickly catch up using the Echolink connection. If you are a member of either club, you are welcome to join us. The Transponder Net is held on the first Saturday of every month at 9:15AM Los Angeles Time and 17:15 in the UK. Just check in a few minutes earlier to let the local host know you are available and then add your 2 cents (or pence) worth."

73 de Mark  
W6MW

*As a footnote, Mark reports that his knee is doing reasonably well after his recent surgery, although it aches from time to time and he is still limping. He hopes to be back in California by mid-month. We wish him well. – Ed.*

## **G3ZMF Operational in** **144 MHz Trophy Contest**

Over the weekend of 5/6 September Frank, G3ZMF, aired the club call sign G4FUR/P from outside his QTH in Banstead. Using an FT 290R emitting just 1 watt and a home built 2

element quad, (see page 12 of this issue of *CATS Whispers*), Frank managed to make some excellent contacts, both on the key and on 'phone. His entry, uploaded by Andy G0KZT, was submitted in the 6 hours "other" section.



This map shows all of Frank's contacts. His best contact was with GM4ZUK/P in locator IO86RW, a distance of 644km. In total, Frank made 17 contacts over the two days and a claimed score of 2988 points was submitted.

Frank commented, "I did not realise that I was only emitting 1 watt until the end of the contest. I thought I had been using a full 2.5 watts!"

Well done Frank. We'll look forward to the final score and your overall position.

Submitted by Andy G0KZT

## **Letter From BY-Land**

Laurence in BY3A writes, "Months of summer oppressive heat seem to be coming to an end and we've exported this commodity to the UK recently, I see!

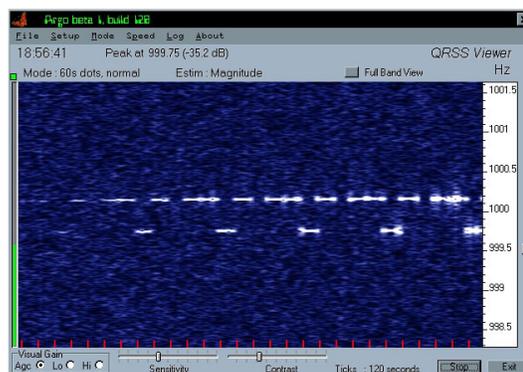
"I had a trip home to Alaska a few weeks ago and between logging down old spruce bark-beetle-killed trees away from the house (a big fire risk here), I set up the Icom R75 receiver with a remote (300ft) K9AY loop and connected back using some RG6U from Walmart. I have remote control of the radio from China using Citrix and Skype/IP sound for audio and ham radio deluxe for the tuning.

"It all works very well considering the rubber band of internet latency. Some success on

HF using WSPR and uploading ARGO screenshots to the web site at <http://kl1x.com>

"The antenna was erected in the Birch forest by the lake, primarily for LF and MF reception for our experimental part 5 licence tests, but in Alaska we've been without darkness for the summer and only now are we seeing the dark side of the ionosphere (!)

"By the way, Argo is a viewer for slow CW, such as QRSS and DFCW. It can cope with signals more than 30dB below the noise. Here is an example of a relatively clear ARGO trace of LF FSK signals from ZL6QH as received in Papua New Guinea. The trace begins at local sunset and the increase in brightness reflects increasing signal strength as night sets in. Note that the red tick marks at the bottom of the screen represent intervals of 4 minutes. This is very slow Morse indeed!



"For more information on ARGO visit: <http://www.sdrham.com/argo/index.html>

"I have a second R75 here in China now and using the active PA0RDT design in that baby bottle and had a surprising WSPR decode on Saturday from SM6BHZ on 503 kHz. At over 7000kms I fell off my seat when I saw a clean decode. I think this is a new distance record.

"As the UK's ERP limit is only 1W, I've asked some of the Europeans to try WOLF, an even stronger error correcting algorithm.

"Apart from that, work keeps me at my desk for 6 or 7 days a week but I'm looking forward to a too short break in October in Maui to recharge our batteries, then to hospital in November for an op on my left ankle, before finally going home again to KL7 for Christmas and New Year. Where I'll be after that is anyone's guess, such is the job market."

73 de Laurence in BY3A

# Low Power Contest 1<sup>st</sup>/ 2<sup>nd</sup> August 2009: Results

A report on the CATS entry into the above contest was published in last month's edition of CATS Whispers. This month Andy, G0KZT writes, "The results for the 144 MHz and 432MHz Low Power 2009 contests for this August have been now published. Full details are given below for our section (the open section). For the other sections, I have included only the top three stations in each to save space. For the full results visit:

<http://www.rsgbcc.org/vhf/results/09/lp144.html> (144 MHz)

<http://www.rsgbcc.org/vhf/results/09/lp432.html> (432 MHz)

## 144 MHz

"In the 144MHz section, our submitted score compared to the adjudicated score showed a loss of three contacts and a loss of four multipliers. This meant a loss of just 65 kilometres (points) and just 448 points from the overall score.

### Open Section

Pos	Callsign	Locator	Postcode	QSOs	Score	Mult	Total	ODX Call	ODX Kms	Power	Ant	Equipment	Group
1*	G0VHF/P	JO01PU	CO	102	25,603	89	2,278,667	F1USF/P	837	25	2x17Y + 1x16Y	FT847 + LNAs	Colchester CG of Colchester RA
2*	G4ZAP/P	IO93EH	SD	138	21,560	98	2,112,880	F4CQY/P	735	25	2x12Y + 2x12Y + Collinear	IC7400	A1 Contest Group
3	G3MDG/P	IO91QS	HP	66	11,112	71	788,952	DK4DH	681	25	2x9Y	FT1000 + TRV-144	Chesham & District ARS
4	G3WIM/P	IO91VG	RH	67	9,669	66	638,154	GI4SNA	533	25	18Y	FT225RD + Mutek	Wimbledon & District ARS
5	G4FUR/P	IO91XG	CR	53	7,855	59	463,445	GI6ATZ	528	25	17Y	TS2000	Coulsdon ATS
6	G3WIR/P	IO91KG	RG	42	6,341	45	285,345	GI4SNA	490	25	2x13Y	FT736R	Burnham Beeches Radio Club
7	G0LGS	IO81WV	GL	20	3,206	26	83,356	G8PNN/P	386	25	9Y + Colinear	IC910H + IC706MkII	Cheltenham ARA

### Single Operator Fixed

Pos	Callsign	Locator	Postcode	QSOs	Score	Mult	Total	ODX Call	ODX Kms	Power	Ant	Equipment	Group
1*	G8HGN	JO01FO	CM	61	14,267	69	984,423	F1USF/P	826	25	2x15Y	FT847	
2*	G4DEZ	JO03AE	PE	42	8,744	51	445,944	F4CQY/P	652	25	4x12Y	IC910	
3*	2E0RCV	JO01AL	SE	51	5,991	48	287,568	EI3GE	453	25	9Y	IC7400	

### Single Operator Others

Pos	Callsign	Locator	Postcode	QSOs	Score	Mult	Total	ODX Call	ODX Kms	Power	Ant	Equipment	Group
1*	M0SDA/P	IO93AD	ST	114	17,275	88	1,520,200	F8KTH/P	636	20	2x18Y	LTS2S SSB + SSB144S + MGF1402	Warrington CG
2*	G0CLP/P	IO84VB	BD	76	13,597	68	924,596	ON7LAO	594	10	10Y	TS700G	
3	G0HDV/P	IO93UK	LN	56	9,555	59	563,745	F1CBC	428	25	12Y	IC746	

## 432 MHz

In the 432MHz section our submitted score compared to the adjudicated score showed a loss of just one contact but the multipliers remained the same. This meant a loss of 543 kilometres (points) and 65,629 points from the overall score.

### Open Section

Pos	Callsign	Locator	Postcode	QSOs	Score	Mult	Total	ODX Call	ODX Kms	Power	Ant	Equipment	Group
1*	G4ZAP/P	IO93EH	SD	68	13,226	72	952,272	DF2VJ	741	25	4x28Y + 21Y + 19Y(vertical) + Colinear	TS850 + Tvtr + FT726	A1 Contest Group
2*	G0VHF/P	JO01PU	CO	51	10,017	55	550,935	GI6ATZ	560	25	4x21Y + 2x21Y	FT847 + LNAs	Colchester CG of Colchester RA
3	G3MDG/P	IO91QS	HP	40	5,606	43	241,058	DF2VJ	599	25	2x21Y	FT1000 + TRV432H	Chesham & District ARS
4	G3WIR/P	IO91KG	RG	30	5,015	41	205,615	GM0USI	556	25	2x19Y	FT736R	Burnham Beeches Radio Club
5	G3WIM/P	IO91VG	RH	32	3,324	29	96,396	DG1KJG	516	25	24Y	FT847	Wimbledon & District ARS
6	G4FUR/P	IO91XG	CR	34	2,550	32	81,600	GW4EVX/P	291	25	19Y	TS2000	Coulsdon ATS
7	G0UTT/P	JO01KQ	CM	16	2,308	23	53,084	F8BRK	284	25	13Y	FT847	Dengie Hundred ARS

### Single Operator Fixed

Pos	Callsign	Locator	Postcode	QSOs	Score	Mult	Total	ODX Call	ODX Kms	Power	Ant	Equipment	Group
1*	G8HGN	JO01FO	CM	30	4,633	39	180,687	GI6ATZ	530	25	2x21Y	FT847	
2*	G4DEZ	JO03AE	PE	25	3,968	27	107,136	DG1KJG	552	25	4x28Y	IC910	
3	G3YDY	JO01FQ	CM	19	3,165	29	91,785	GI6ATZ	524	25	19Y	FT847 + Preamp	

### Single Operator Others

Pos	Callsign	Locator	Postcode	QSOs	Score	Mult	Total	ODX Call	ODX Kms	Power	Ant	Equipment	Group
1*	G8XVJ/P	IO93AD	ST	65	11,488	69	792,672	DF2VJ	750	20	2x30Y	LTS70S SSB + SSB70S + MGF1402	Warrington CG
2*	GW4EVX/P	IO83JA	LL	38	7,001	50	350,050	F8BRK	471	20	19Y	FT857D	
3	G0LGS/P	IO81XV	GL	22	3,706	31	114,886	GM0USI	469	25	23Y	IC910H	Cheltenham ARA

“On the subject of score accuracy, October’s RadCom covers this in more detail. See page 68. “

73 de  
Andy G0KZT

## JOTA



This year's Jamboree On The Air (JOTA) is on 17th/18th October and once again Stuart, G6CJR, is looking for amateurs to help him with the event he is leading at Banstead Scouts. If you are interested, please give him a call or email – you'll have a lot of fun!

## CATS Bazaar

The 32nd annual CATS Radio & Electronics Bazaar, takes place this year on Sunday November 15th 2009, with admission to the public from 10:00 am to 2:00 pm.

CATS is again grateful to receive sponsorship from SYCOM ([www.sycomcomp.co.uk](http://www.sycomcomp.co.uk)).

This year's event features: new and second hand equipment, a flea market, traders' stalls, CATS Bring & Buy, refreshments, disabled access and toilet, and free parking. Admission costs £1 – and includes a free cup of tea.

The bazaar is being held at the 1st Coulsdon Scout Group HQ Lion Green Road Car Park Coulsdon, Surrey, CR5 3BD.

With all tables now allocated, this promises to be a busy and successful event.

If you would like to help – either with set up at 5pm clock time on the previous day or at the event itself - please contact CATS Secretary Andy, G8JAC, at [secretary@catsradio.org](mailto:secretary@catsradio.org)

## Contests Coming Soon

Oct 8: 80m Club Sprint (CW)  
Oct 11: Second 50 MHz Contest  
Oct 21: 80m Club Sprint (SSB)  
Nov 7/8: 144 MHz CW Marconi

Nov 12: 80m Club Sprint (SSB)  
Nov 14: Club Calls Contest (1.8 MHz)  
Nov 21/22: 2nd 1.8 MHz contest  
Nov 25: 80m Club Sprint (CW)  
Dec 6: 144 MHz AFS  
Dec 26-29: 50/70/144/432 Christmas Cumulatives Contest

## Local Rallies & Events

**9/11 October 2009**

**RSGB Convention**

**Wyboston Lakes Conference Centre**

Lecture streams (see September issue of CW)

[www.rsgb.org/rsgbconvention](http://www.rsgb.org/rsgbconvention)

**13/14 October 2009**

**EMCUK Exhibition**

**Newbury Racecourse**

RSGB stand

IEEE demonstration bench

You need to register on line for free tickets at:

[www.emcuk.co.uk](http://www.emcuk.co.uk)

**15 November 2009**

**CATS Bazaar**

1st Coulsdon Scout Group headquarters, Lion Green Road in Coulsdon, Surrey. [Map](#)

Open 10:00 to 13:00

Parking, trade stands, bring and buy, refreshments

Contact: [enquiries@catsradio.org](mailto:enquiries@catsradio.org) or

[www.catsradio.org](http://www.catsradio.org)

**7 February 2010**

**25th Canvey Radio & Electronics Rally**

'The Paddocks', Long Road, Canvey Island, SS8 0JA

Open 10:30

Parking, Catering, Disabled Facilities, Trade Stands

Contact: Dave, G4UVJ, 01268 697978 (evenings)

[www.southessex.ars.btinternet.co.uk](http://www.southessex.ars.btinternet.co.uk)

**18 February 2010**

**Rainham Radio Rally**

Rainham School For Girls, Gillingham, Kent

Contact Trevor, G6LYW, 0771 7678 795

## Shak Nowtz

Over the page you will find the sixth in a series of articles written by "mad" Frank, G3ZMF. This one is entitled Beams and Yagis Made Easy. The next issue of Shak Nowtz will cover whip antennas.



# SHAK NOWTZ BY "MAD" FRANK - G3ZNF

## SHAK NOWTZ No 6 - Beams and Yagis Made Easy

### Introduction

In the same way that the vacuum cleaner is often called a "Hoover" after the original manufacturers and any multimeter can be called an "Avo" – at least by the older generation – people often use the term "Yagi" to refer to an antenna that focuses the radio frequency energy (RF) into a beam.

Back in 1926 [1] a Mr Uda and a Mr Yagi in Japan developed the idea of adding directing and reflecting elements to a dipole to focus the RF into a beam, instead of the simple bi-directional radiation from the basic antenna.

When teaching Scouts and Guides and those new to radio, I often explained that a torch without a lens produces a low level of light in all directions, just like a simple vertical antenna. But with a lens in place, the same amount of light is focused into a beam. This beam, although still having the same power output, is now more intense in one direction.

In the same way, by adding a reflector of one type or another behind the driven element (or dipole), and directing elements in front of it, the same amount of RF power is concentrated into a tight beam. The antenna effectively exhibits a forward gain with respect to a basic dipole.

The gain of a dipole compared with an antenna that radiates equally in all directions (isotropic) is 2.15 dB. The gain of a beam antenna can be quoted as dBd (gain relative to a dipole) or dBi (gain relative to isotropic). The dBi figure would be 2.15 dB more than the dBd figure. If a manufacturer merely quotes "dB" you need to ask whether they mean dBi or dBd - or you could end up getting 2.15 dB less gain than you believe you are paying for.

Remember that doubling of power equates to 3dB of gain and quadrupling of power equates to 6dB gain – the generally-accepted definition of an S-point. Also gains add, so that if the transmitting station's antenna has a gain of 6dBd and the receiving antenna has a gain of 11dBd, the total gain is 17 dB compared with

both stations using dipoles. This is a factor of fifty!

### Practical Designs

I claim no originality for the beam designs that follow. They are for 144, 432 or 1296 MHz and all come from articles published in well-known books and magazines – and my personal experimentation, of course! They may also be scaled for 50 MHz and 70 MHz.

Feeding a beam with coaxial cable (coax) presents an unbalanced feed and, in general, beams require a balanced feed to ensure maximum RF power transference between rig and antenna without incurring adverse VSWR and hence radiation/TVI from the coax. (See Shak Nowtz No 5.)

### 144 MHz 4 Element Yagi

My choice of driven element (DE) plus director (D1) at 0.125 wavelength spacing ahead of the DE for this antenna goes back to the J Beam principle and experiments in the 1960s. They found on test that a dipole plus one director at 1/8 wavelength gave a measured forward gain of 4.2 dBd - better than other possible spacings. The J Beam tests also found that a total gain of 7.2 dBd was possible by adding a reflector (REF) at 1/4 wavelength behind the driven element and a second director (D2) 1/4 wavelength in front of the first.

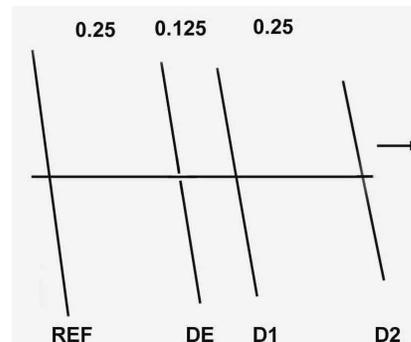


Fig 1: 4 element Yagi

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In a straight "beam" as in Fig 1, with a half wave dipole as the DE, the approximate element lengths in metres are as follows:

$$DE = 0.95 \times 150 / f \text{ (in MHz)}$$

$$REF = DE \times 1.05$$

$$D1 = DE \times 0.95$$

$$D2 = D1 \times 0.95$$

Spacing is  $0.125 \times 300 / f$  (in MHz) or  $0.25 \times 300 / f$  (in MHz)  
(with no correction factors)

## 144 MHz 2 Element Quad

I have used the following antenna both portable and from the home QTH. It is made from seamless aluminium tube that I salvaged from scrapped camping equipment.

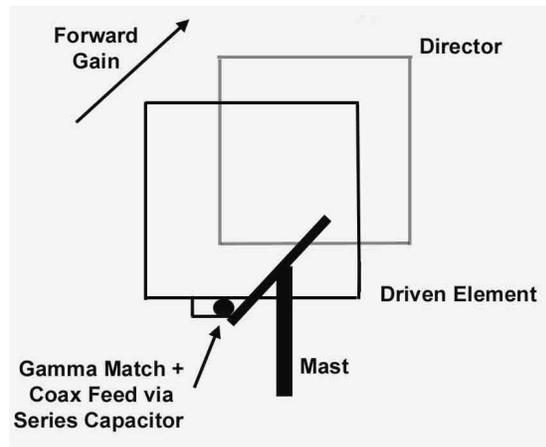


Fig 2: General arrangement of the 2 element quad for 144 MHz, as used by G3ZMF

Director =  $0.95 \times 300 / f$  metres  
Driven Element =  $300 / f$  metres  
Where f is frequency in MHz

## The Quad - How It Works

By doubling the number of elements, a 3 dB advantage can be gained. So what is a Quad – other than a pair of stacked beams, of equal length?

Originally developed in the 1940's at the

broadcasting station HCJB in Quito, Ecuador, to overcome arcing at element ends in a humid atmosphere at high altitude, the quad can best be explained by considering the following evolutionary steps (see figure three, below.)

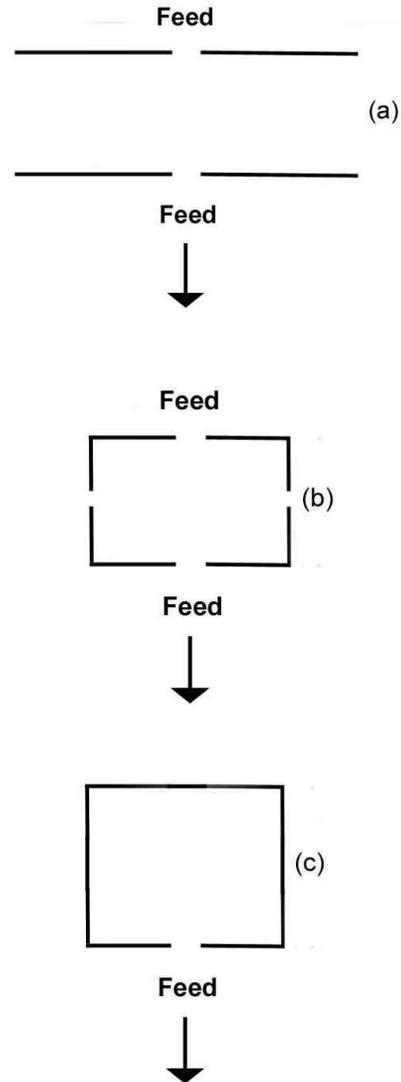


Fig 3: Development of quad antenna concept  
(a) - 2 dipoles  
(b) - dipole ends folded in  
(c) - ends joined to form one wavelength loop  
(All with balanced feed)

Some form of balun is required to match the feed point. Don't forget that the more elements you add, the lower the natural feedpoint impedance becomes and that some degree of

# SHAK NOWTZ No 6 - Beams and Yagis Made Easy

reactance may well develop.

To deal with this, I like to use either the gamma match (figures 2 and 4) or delta match (fig 5). On 144 MHz I use a wide-spaced Jackson 804 ceramic-bodied capacitor of max value 15 pF and only need 2 – 4 pF of effective capacitance. Don't forget that both sides of this capacitor are live to RF and as the value is so low, it is very susceptible to hand capacitance as you tweak it for best VSWR.

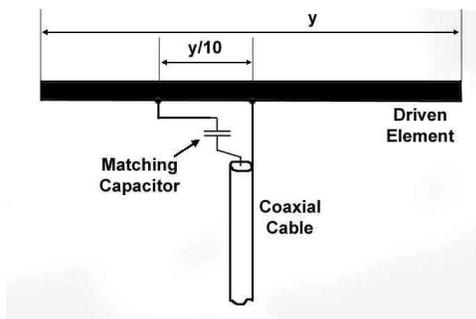


Fig 4: Detail of gamma match

The gamma matching section can have many variables such as its diameter in relation to the DE, the spacing between gamma arm and DE, length of gamma arm, and position of shorting point to DE.

Q1. What's the gamma arm doing?  
A1. It's finding the point of correct impedance on the DE (50 ohms.)

Q2. What's the series capacitor doing?  
A2. It's providing capacitive reactance to equalize the inductive reactance of the gamma arm to give a resistive feed, albeit unbalanced.

In other words, when  $X_C = X_L$  then only resistance is left, in the same way that the capacitor was used in the HF/LF earth lead described in Shak Nowtz No 5.

Delta feed: = "DC" feed + no capacitors – so no final trimming – but take care! You must include the length of coax inner protruding from the point where the braid of the balun coax is pigtailed. But once you get the lengths of the delta arms right, the results are most impressive.

## Delta-fed Beam For 430/ 440 MHz

Designed by DL6WU [1]

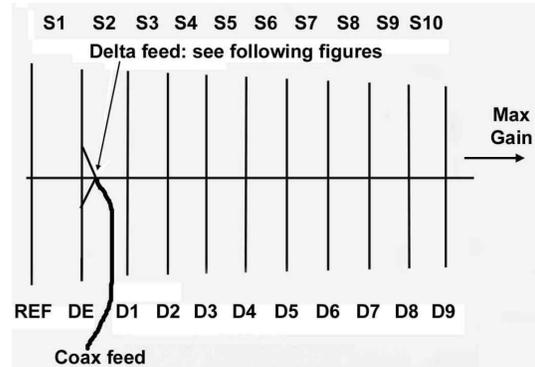


Fig 5: Delta fed beam for 432 MHz

For lengths and spacings of an antenna centred on 435 MHz, see Table 1.

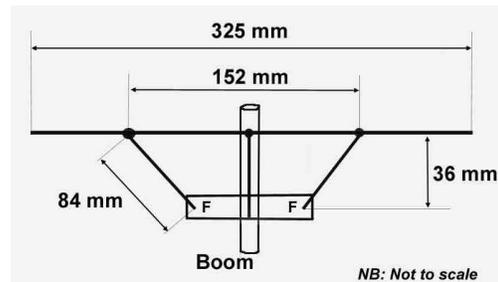


Fig 6: Close-up of driven element. See also Figs 7 & 8

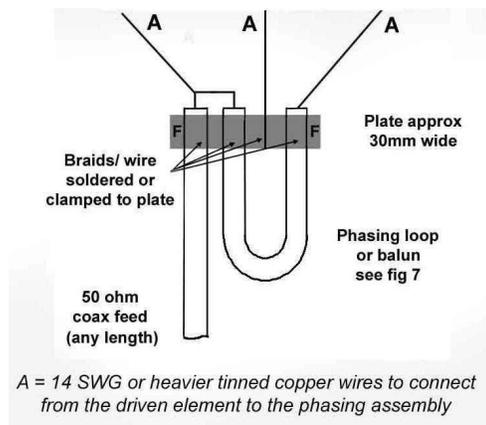
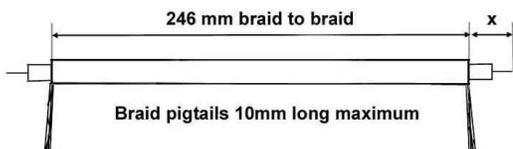


Fig 7: Phasing assembly

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NB: Not to scale

Fig 8: Details of phasing loop, before bending into a U shape. NB: the length marked "x" must be included in the 84 mm delta feed arms

TABLE ONE		
DL6WU 435 MHz Beam Dimensions		
Element		Length
Reflector	REF	330 mm
Driven El	DE	325 mm
Director 1	D1	295 mm
Director 2	D2	290 mm
Director 3	D3	285 mm
Director 4	D4	280 mm
Director 5	D5	275 mm
Director 6	D6	275 mm
Director 7	D7	270 mm
Director 8	D8	270 mm
Director 9	D9	265 mm
Elements		Spacing
REF- DE	S1	130 mm
DE-D1	S2	55 mm
D1-D2	S3	125 mm
D2-D3	S4	150 mm
D3-D4	S5	195 mm
D4-D5	S6	195 mm
D5-D6	S7	210 mm
D6-D7	S8	220 mm
D7-D8	S9	230 mm
D8-D9	S10	240 mm

It will be noticed that the spacing of the directors gets progressively larger. This beam was designed on a computer and proved in tests. For a larger beam, see [2].

As I was experimenting for the first time with this design and would only be using it indoors I used 2.5 sq mm copper for the delta arms. For a more permanent antenna, the coax inner

could be cut so that the insulated inner conductor becomes the arms of the delta.

My results (after final adjustment of the length of the delta arms) was as follows:

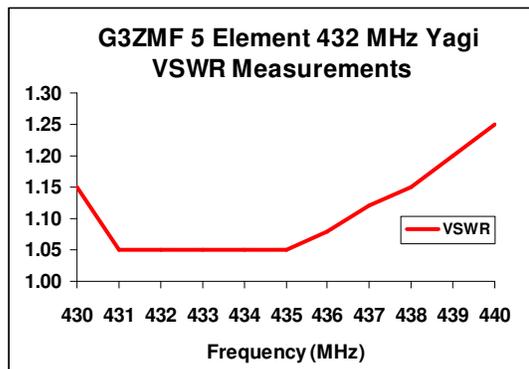


Fig 9: Graph of actual measurements of G3ZMF's antenna

My indoor version was only 5 elements in total, had an overall length of 485 mm and was built on 25 mm plastic conduit.

This antenna can be scaled up or down to suit frequencies from 50 MHz to 1296 MHz. For example, for operation on 144.5 MHz, multiply all dimensions by 435/144.5. Similarly, for operation on 70.3 MHz, multiply all dimensions by 435/70.3.

Have fun – and let me know how you get on.

73

"Mad" Frank, G3ZMF

## References

- [1] New Beam Antenna Book, ISBN0-933616-04-X by William I Orr W6SAI and Stuart D Cowan W2LX, published 1983 in USA. chapter3, p61 refers.
- [2] Same book, pages 122,123.

Additional Reading:  
 RSGB VHF/UHF Handbook, RSGB Radio Communications Handbook.

## Other Club News & Contact Information

### **BROMLEY & DISTRICT ARS**

**Website:** [www.bdars.org.uk](http://www.bdars.org.uk)

**Email:** [bdars-news@talk21.com](mailto:bdars-news@talk21.com)

**Meetings:** 3<sup>rd</sup> Tuesday of every month at Victory Social Club, Kechill Gardens, Hayes, Kent, 19:30 for 20:00.

### **CPREC (CRYSTAL PALACE)**

**Website:** [www.qsl.net/g3oou/](http://www.qsl.net/g3oou/) or

<http://www.g3oou.co.uk/>

**Club Net:** Wednesdays 20:00 on 145.525 MHz

**Meetings:** 1<sup>st</sup> Friday at All Saints Church Parish Rooms, Beulah Hill at 19:30

**6th Nov 09** - EGM

**4th Dec** - Christmas Social

### **CRAWLEY ARC**

**Website:** [www.carc.org.uk](http://www.carc.org.uk)

**Club Nets:** Tuesdays 20:00 on 145.550 MHz and Fridays 19:00 on 1.970 MHz

**Meetings:** Every Wednesday at Hut 18, Tilgate Forest Recreational Centre, Tilgate Forest, Crawley from 19:30, and Sundays, 10:30 to 13.00.

### **CRAY VALLEY RS**

**Website:** [www.cvr.org](http://www.cvr.org)

**Contact:** Richard Perzyna, G8ITB (see website)

**Club Nets:** Wednesdays 21:00 on 145.500/QSY and 22:00 on 3.720 ± QRM, and Sundays 11:00 on 3.720 ± QRM

**Meetings:** 1<sup>st</sup> and 3<sup>rd</sup> Thursdays at Progress Hall, Admiral Seymour Road, Eltham, SE9 1SL.

### **DORKING & District RS**

**Website:** <http://www.ddrs.org.uk>

**Email:** [ddrs.secretary@yahoo.co.uk](mailto:ddrs.secretary@yahoo.co.uk)

**Contact:** David Smith, M0SXD, 07808579501

**Club Nets:** Sunday 08:15 on 3.770 MHz & 20:30 on 144.775 MHz

**Meetings:** Friends Meeting House, Butterhill, South Street Dorking at 19:30.

**27th Oct** - The assessment of receiving system performance - Ranulph Poole & John Slater.

**24th Nov** - Millimetre wave radio propagation/antennas - Dr David Browning.

**22nd Dec** - Christmas Dinner

### **HORSHAM ARC**

**Website:** [www.harc.org.uk](http://www.harc.org.uk)

**Club Nets:** Saturdays 21:30 on 144.725MHz and Sundays 10:00 on 3.722 MHz

**Meetings:** 1<sup>st</sup> Thursday at The Guide Hall, Denne Road, Horsham, Sussex

**5th Nov** – Electrical oddities - John Narborough

**15th Nov** - Sunday Morning Fox Hunt

**3rd Dec** - AGM

**5th Dec** - HARC Christmas Bash -Staplefield

### **MID SUSSEX ARS**

**Website:** [www.msars.org.uk](http://www.msars.org.uk)

**Club Nets:** Sundays 08:00 on 3.740 MHz and at 11:00 on 145.350 MHz, Wednesdays 20:00 on 145.350 MHz and Daily 13:30 on 21.330 MHz

**Meetings:** Every Friday at Cyprus Hall, Cyprus Road, Burgess Hill, West Sussex for 19:45

### **REIGATE ATS**

**Website:** [www.qsl.net/rats](http://www.qsl.net/rats)

**Email:** [rats@qsl.net](mailto:rats@qsl.net)

**Club Nets:** Thursdays 20:00 on 145.500 MHz and Sundays 20:00 on 3.740 – 3.760 MHz

**Meetings:** 3<sup>rd</sup> Thursday at RNIB, Redhill College, Philanthropic Road, Redhill for 19:30

### **SRCC**

**Website:** [www.g3src.org.uk](http://www.g3src.org.uk)

**Contact:** Ray Howells G4FFY 020 8644 7589

**Club Nets:** Sunday 09:30 on 1905 kHz

Daily natter channel – 144.215 MHz at 19.30.

**Meetings:** 1<sup>st</sup> & 3<sup>rd</sup> Mondays at Trinity School, Shirley Park, Croydon CR9 7AT 19:45 for 20:00

**2nd Nov** - TBA

**7th Dec** - TBA

### **SUTTON & CHEAM RS**

**Website:** [www.scrs.org.uk](http://www.scrs.org.uk)

**Contact:** John Puttock G0 BWV 020 8644 9945

**Club Nets:** Monday 20.00 on 145.500 MHz

Saturday 11.00 on 145.500 MHz

**Meetings:** 3<sup>rd</sup> Thursday at Sutton United Football Club, The Borough Sports Ground, Gander Green Lane, Sutton. 19:30 for 20:00

**15<sup>th</sup> Oct** – Power Line Transmission, John Pink G8MM

**19th Nov** – Weak Signal Propagation Reporter (WSPR), Walter Blanchard, G3JKV

**10<sup>th</sup> Dec** – Christmas Junk Sale

### **WIMBLEDON & DISTRICT ARS**

**Website:** [www.gx3wim.org.uk](http://www.gx3wim.org.uk)

**Club Net:** Mondays 20:45 on 145.500 MHz

**Meetings:** 2<sup>nd</sup> & last Friday of each month at Martin Way Methodist Church, Buckleigh Avenue, Merton Park SW20. 19:30 for 20:00

**9th Oct** - Construction Evening

**30th Oct** - Annual General Meeting

**13th Nov** – On air with Morse

**27th Nov** - Surplus Equipment Sale

**11th Dec** - Christmas Social

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