PACK RATS' CHEESE BITS

CLUB CALL: W3CCX

MT. AIRY VHF RADIO CLUB, INC.

MT AIRY VHF RADIO CLUB., "THE PACK RATS", PHILADELPHIA, PA. W3CCX
FREQUENCIES: 50.125, 144.150, 222.125, 224.58/222.98, 432.110, 903.100, 1296.100 MHz
AFFILIATED CLUB: AMERICAN RADIO RELAY LEAGUE ARNS

Meetings: Third Thursday of each month at 8:00 PM
Southampton Free Library, 947 E. Street Road
Southampton, Pennsylvania 18966

VOLUME XXXV MARCH 1993 NUMBER 3

THE PREZ SEZ

Beware the "ides of March" is an old saying but it has historical significance. As we move into March and the winds begin to blow they signify the change that is about to take place as Spring arrives. Change is always taking place. In a Club you need change to keep things interesting. I get involved with change when the March winds and wet snow's bend a mast or crush a antenna or two. But I would still put up new antennas and strive to make my station better. Each of us will face change and with it you have an opportunity to try new things, like a new band. However Ham Radio is a hobby and that means that you are most likely in it because you like some facet of it. These facets are what allows a club to be diverse and survive change. It also means that if you don't like the microwave bands you don't have to operate them. Our club is a collection of individuals, so let us all pull together to survive the changes that are ahead for all of us.

This past Month was the Annual Crying Towel meeting. This in my opinion is one of the top meetings of the year. We had a great January contest. Our scores are up significantly from last year, and everyone who participated is to be congratulated. We put in a excellent effort. Did we win ? We must wait and see. In the mean time let's improve for next year, we can start by getting old members active and new members on new bands. And by getting on the air and being active.

73's

William T. Murphy
W0RSJ FN20JR

Pack Rats CHEESE BITS is a publication of the Mt. AIRY VHF RADIO CLUB, INC. Philadelphia, PA. and is published monthly.

SUBSCRIPTION RATE: $10.00 PER YEAR (USA)
$12.00 PER YEAR (CANADA)
$15.00 PER YEAR (ELSEWHERE)

We operate on an exchange basis with other publications. Anything that is printed in CHEESE BITS may be reprinted, unless otherwise stated, provided proper credit is given.

DEADLINE FOR ARTICLES AND SWAP SHOP IS THE MONTHLY MEETING DATE. NON-COMMERCIAL SWAP SHOP ITEMS-FREE OF CHARGE.

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PACKRAT 222 MHz REPEATER - W3CCX/RPTR
222.98/224.58 MHz, Churchville, PA

MONDAY NIGHT NETS

TIME	FREQ.	NET CONTROL
7:30 PM	50.125 MHz	K3EOD
8:00 PM	144.150 MHz	W2EIF
8:30 PM	222.125 MHz	WB2YEH
8:30 PM	224.58R MHz	K3ACR
9:00 PM	432.110 MHz	WA3AXV
9:30 PM	1296.100 MHz	WA3NUF
10:00 PM	903.100 MHz	N3AOG

COMMITTEE CHAIRMEN

LADIES' NIGHT:	WA3YUE	215-666-1558
JUNE CONTEST:	N3CX	215-679-7293
HAMARAMA:	K3EOD	215-742-3312
VHF CONFERENCE:	KB3XG	215-270-3158

TID BITS Cont'd:

Proposed FCC regulation changes affecting 222 and 1296 MHz are proposed in P. R. Docket #640. Changes to 222 MHz will add a 150 kHz segment for weak segment use prohibiting repeater use and allowing novices to use the entire band. The deadline for responses is unknown so get your comments in soon.

In WB6IGP's "Above and Beyond "column in the March issue of &3, Chuck discusses RF actuated switches and relay sequencing. Schematics of real circuits are provided.

In Dave, G8ROU's Jan 93 issue of "The VHF-UHF DXer", there is an article by John, G4SWX, on "A No-Tuning Power Fet Pre-Amp". It uses a MGF-1801 on 2 meters and has a NF of 0.34 dB with a gain of 20 dB. It's a no-tune world. Also in this issue, it is reported that as on Jan 15, Poland has 6M privileges and on 1 Jan, the Czech Republic (OK and OL stations) and the Slvak Republic (OM) are on 6M.

New Member

Dave Foster, WD5BRP, 2120 Hillcrest Drive, Easton, Pa. 18042
(H)215-253-3775 (W)215-253-5903

Visitors to the February Meeting

KA3VKW, Ed Almasy, North Wales. Pa.
N3IIB, Bill Krimmel, Willow Grove, Pa.
W2EA, Walt Schmidt, Haddenfield, N. J.

Health and Welfare

One of the founding fathers of the club, Len Ciucci, W2GGB, became a silent key in late January. We'll all miss "Go Go Baby".

The father of Ron Allen, KB3QM, has passed away and Ron's mother is in the hospital.

SWAP SHOP

Send non commercial swap shop items to the editor.

Wanted: 25 watt 220 Synthesized FM Rig, 220 MHz Microwave Modules Transverter, 6 Meter Transverter of Transceiver. I'm tired of these crummy contest scores! Call Dave, WB8ZAR, 717-366-2220.

For Sale: 2 ea. 100 ft. rolls of 7/8 in. Prodlin hardline. One with female conn. that are corroded and the other with male conn. $25.00 per roll. Motorola 903 MHz 5 mw. input/10 watt output class A linear amplifiers on machined aluminum housings, +24 volts, SMA connectors, $75.00 each. Call Gary, WA3OMY at 215-539-6409.

For Sale: Microwave Modules MMT 144/28 Transverter, 25 watts out with GaAs FET Preamp, $215.00. Call Jeff Klein, 203-452-7656.

COMMERCIAL AD

LOOP YAGIS: 902 MHz 33 element $89 kit, $109 assembled and tested. 1296 MHz 45 element, $89 kit, $109 assembled and tested. 1296 MHz 55 element "Sooper Looper" $99 kit, $124 assembled and tested. 2304 MHz 45 element $75 kit, $89 assembled and tested. Also available: element and hardware kits for the above. 2 and 4-way power dividers. Discount on complete arrays. Solid State Linear Power Amps, 13 VDC: 1296 - 8W in 35W out $315, 1W in 20W out $265, 4W in 70W out $695. GaAs FET Preamps: 903 MHz .8dB NF $90, 1296 MHz .8 dB, 2304 MHz 1 dB max NF $140. SHF SYSTEMS No-tune Transverter kits, w/144 MHz IF now available for 903 through 3456 MHz. Write or call for complete catalog. DOWN EAST MICROWAVE, Bill Olson, W3HQT, Box 2301 RR-1, Troy, Maine. For information and orders telephone (207) 948-3741.

Calendar of Coming Events -March 1993

6 Shore Points ARC Springfest 93 at Holy Spirit High School, Rte 9, 1/2 mile S. of Rte 30 in Absecon, NJ. TI on 146.385/985.

6-7 ARRL Int. DX Contest (phone). See page 125 of the Dec. Issue of QST for rules.

6 Annual North Jersey Hamfest on Morris Ave. in Denville, NJ. Talk-in on 146.385/.985 .52S and 223.86/.26. VE exams will be given.

11 Packrat Board of Directors Meeting at the QTH of Pat, WB3DNI. All interested parties welcome. Starts at 8:00 P.M. Call 215-672-5289 for directions.

13 Flemington, N. J. Cherryville Repeater Association Hamfest at the Hunterdon Central High School Field House. TI on 147.975/375 and .52.

14 6th Annual York Springfest at the York Fairgrounds, York, Pa. VE exams will be given. Talk-in on 146.37/.97. VE exams will be given.

17 St. Patrick's Day.

18 March meeting of the Mt. Airy VHF Radio Club at 8:00 P.M. at the Southampton Free Library on Street Rd. The program will be the annual HOME BREW Night. Bring your successes, failures and works in process to share with all. You do not have to be a member to enter. All interested VHFers and microwave enthusiast are welcome. Prizes will be awarded in several categories.

20 Death of Brendan, Dublin 1964.

21 The Pen-Del Hamfest will be held at the NUR Temple, 198 DuPont highway (Rte 13 near US40 split), Newcastle DE. Talk-in on 224.220 and 147.225+.

21 Delaware Valley Radio Association will host HAM-COMP '93 at the Mercer County Community College on Old Trenton Road in West Windsor NJ. Talk-in on 146.07/.67 and .52.

27-28 Timonium Md. Greater Baltimore Hamboree and Computerfest at the Maryland State Fairgrounds. VE exams given. Talk-in on 146.07/.67.

TID BITS:

Geoff, WA2GFP, had the unfortunate honor of winning the "Crying Towel" for his story on what went wrong during the January contest. Can you believe being taken to the police station while operating as a rover in your own neighborhood? Note that Geoff is also a lawyer in addition to being nuts and going roving.

Note the January contest results listed elsewhere in this issue. The results show an outstanding effort by all. The overall club score went up by 40% or 594K over last year. The average score for the 56 logs submitted was 36.7K points. In the club internal team competition, the preliminary results show the K3ESJ team far ahead of the competition.

Dave, N3CX, has had to decline the job of heading up the June Contest for the club. Pat, WB3DNI, has accepted the challenge. Plans are again to operate from Camelback Mt. in FN21.

New work phone number for Paul Drexler, WB3JYO: 908-542-1133.

Preliminary contest info from the Upper Midwest VHF/UHF Newsletter: Single Op scores listed to 74K points with grid counts up to 154. N0HJZ/R had 248 grids and a prel score of 321K points.

Mt. Airy VHF Radio Club Inc.
The Packrats
January 1993 VHF Sweepstakes Contest

Total Logs 56

Total Club Score 2057340

Call	50Mhz		144Mhz		222Mhz		432Mhz		903Mhz		1.2Ghz		2.3Ghz		3.4Ghz+up		Totals Contacts	Grids	Score
WA3NOP	137	25	226	27	76	20	95	24	32	7	49	13	20	4	16	5	651	125	164625
W2SB	67	13	199	29	79	19	89	22	37	9	35	6	19	4	12	4	537	106	120628
K3RSJ	119	23	379	35	81	17	99	20	30	5	30	5					738	105	115290
WA3TUE	120	20	233	29	77	15	84	16	31	9	35	9	16	4			596	102	108834
WB3DNI	56	12	215	25	51	8	84	17	31	7	44	9	18	3	16	3	515	84	93492
WB2YEH	70	14	181	19	75	12	80	14	32	8	39	7	23	5	12	2	512	81	91125
WB3JYO	14	2	173	26	73	16	77	16	32	9	40	8	18	5			427	82	75358
WA2OMY	33	7	144	22	45	3	87	19	33	7	26	5	15	3	8	4	391	70	60270
W3KYV/R	7	5	189	43	51	14	71	17			24	10					342	89	47704
KB3IB	35	12	141	26	64	12	29	6	30	9	34	9					333	74	45732
AK3O	85	13	125	13	55	7	67	10	28	5	29	5	16	3			405	56	45360
W3KKN	104	16	114	13	66	9	56	11	25	3	37	6	4	2			406	60	44520
WA3JDF	35	5	77	7	62	11	69	13	18	5	34	8	15	5	3	1	313	55	39930
N3AOG	30	5	114	17	37	2	56	10	26	5	27	5	13	3	11	5	314	52	38168
W3ITT	72	14	199	29	58	8	59	11			8	2					396	65	34905
N3ITT	67	12	187	20	38	4	57	12			23	5					372	53	28408
N3BBI	344	57	71	7													415	64	26560
KB3XG	23	6	58	9	39	7	36	7	22	2	26	5	14	3	8	2	226	41	24559
W2KIF	39	8	118	13	44	7	45	9	14	3	23	3	2	2			285	45	22455
WA3AQA	91	15	147	18	59	9	44	7									341	49	21756
K3DMA/R	46	8	101	17	58	7	52	9			17	5					274	46	20010
W3VIR	55	11	62	10			45	6	18	4	22	7	7	3			209	41	17343
K3IUV	33	6	103	14	59	4	65	10			16	2					276	36	16128
W3GAD			197	24			90	18									287	42	15834
K3GYS	52	14	113	10	29	7	30	3	12	3	17	2					253	39	15561
W3GXB	32	5	125	16	42	5	48	7	17	3							264	36	14580
WA3EHD	71	12	158	14	54	4	45	4									328	34	14518
WA3IAC	10	2	115	8	45	4	47	6	20	3	10	2					247	25	10725
WB8ZAR			136	19	9	3	30	8			14	3					189	33	8910
N3MGE			107	12	47	7	56	9									219	28	8764
K3EBZ	13	2	126	12	39	2	10	2			14	2					202	20	5860
WB3P	40	7	111	14	38	2											189	23	5221
K3BPP	51	10	25	4	23	2	30	5			7	1	1	1			137	23	5014
WB2VLA	37	9	44	8	26	2	24	5									131	24	4344
W3HFY	24	4	26	6	22	2	29	5	8	2	1	1					109	20	3680
KA3MGB	39	11	34	6	6	3											79	20	1700
WA3NFV	20	2	79	3	35	4											134	9	1521
K3PHY			137	6	21	1	1	1									159	8	1448
W3HK	36	5	53	6	6	1	4	1									99	13	1417
N2DEQ			92	12	2	2											94	14	1344
N3NIA			76	15													76	15	1140
WA2GFP			36	7	27	4											63	11	990
WB3EHO			72	3	31	2											103	5	670
W3CXU	1	1	17	2	21	1	5	2									44	6	420
KS2T	32	10			3	1											35	11	418
K3JJZ			34	2	2	2											36	4	152
WB3KBW			18	2	10	1											28	3	114
K3YEQ	2	1	19	2													21	3	63
N3GSA			11	2													11	2	22

Multi-Ops

Call	50Mhz		144Mhz		222Mhz		432Mhz		903Mhz		1.2Ghz		2.3Ghz		3.4Ghz+up		Totals Contacts	Grids	Score
WA3AXV	80	16	345	33	117	20	176	25	45	13	72	19	26	8	27	7	888	141	268323
W/WA3AXV,WB3KBW																			
N3RSJ	160	27	283	30	59	16	87	21	21	6	31	7	13	4	3	3	657	114	122094
W/N0BSJ,WB2ONA,K3MKZ,NET																			
N3CX	73	9	102	18	93	17	96	21	31	8	45	12	17	4	17	4	474	93	104997
W/N3CX,WA3JUF																			
WD5BRP/R	96	23	262	42	30	11	54	16			10	5					452	97	54902
W/WD5BRP,KU3T,NET																			
N3EXA	95	12	223	19	63	13	61	10	23	4	26	3					491	61	46482
W/N3EXA,KY3T,+NET																			
K3EOD	97	14	163	14	66	6	64	7	20	2	18	3					428	46	30912
W/K3EOD,K3JJZ,N3INY,KA3WWK,NET																			
K3DLS/R	10	6	55	11													65	17	2040
W/K3DLS,WA3TUL,+NET																			

A review of "The VHF/UHF DX Book"

By Harry, W3IIT

Thru an ad in the VHF-UHF DXer, I ran across a new English book that should be of interest to the VHF/UHF community. The "VHF/UHF DX Book" is edited by Ian White, G3SEK, and published by DIR Publications, Ltd, PO Box 771, Buckingham MK18 4HH, England. The price is 18 pounds plus postage direct from the publisher (I'm not aware of anyone in the US distributing it-the publisher will accept a VISA card).

The book is strictly VHF/UHF ending at 432 MHz. It is a fundamental book covering the basics that the average VHFer needs to know. It is not an advanced book with all of the latest circuits but it is solid covering the basics more thoroughly and up to date than any book that is currently available. It is highly referenced for those wanting to dig in more. It's 12 chapters are as follows:

Chapter	Contents
1	Introduction
2	VHF/UHF Propagation
3	Operating
4	Assembling your Station
5	Receivers and Local Oscillators
6	Transmitters, Power Amplifiers and EMC
7	Beam Antennas and Feedlines
8	144 MHz
9	50 & 70 MHz
10	432 MHz
11	Power Supplies and Control Units
12	Test Equipment and Station Accessories

The highlights (to me) are the chapter on propagation. It covers 67 pages and starts with basic theory and covers tropo, aurora, Sporadic-E, FEI, F2, TEP, scatter, MS, and EME. There's much for most of us to learn here and to refresh what we've learned in the past. Many references are provided with many of them being US publications.

The chapter on assembling your station is must reading if you want to be serious on the VHF bands. It covers receiver sensitivity, system noise figure, line losses, antenna noise temperature, path loss and their effects on your stations ultimate capabilities.

Chapter 5 talks about strong signal performance (that's contest operation or local strong commercial signals), and it includes intermodulation, gain compression, Local Oscillator noise, dynamic range, and mixing. Intermod analysis is discussed and methods for figuring out what your equipment will perform are presented. Preamp selection is discussed as well as what's frequently wrong with commercial equipment including some possible fixes.

Chapter 6 discusses types of amplifiers, how much power is needed, IM distortion, linearity, PEP, the 4CX series and 88 series of tubes cooling methods, neutralizing, and the effects of speech compression.

Chapter 7 on antennas is by DL6WU. Not much more needs to be said. Discussed are gain, patterns, feed impedance, bandwidth, capture area, noise, types, ground reflections, stacking, and recommendations for the serious VHFer. Element spacing for DL6WU yagis is provided with a curve of director lengths based on element diameter. Commercial antenna performance is shown in a table with claimed vs NEC calculated gain.

The next 3 chapters describe construction of transverters, amplifiers and antennas for the bands thru 432 MHz. Printed circuit board patterns are provided. One interesting circuit in the 50, 70 and 144 MHz transverters is an ALC circuit. The main components are an Op Amp and a junction FET/pin diode attenuator. It's worth considering for your next project even if you don't build the whole transverter. I recommend that this circuit be added to the other VHFers that operate close to me.

Chapter 11 has an extensive discussion on tube type power supplies with regulators and overload and interlock circuits. TR switching, sequencing and protection of DC supplies for GaAsFets is also provided.

Chapter 12 shows how to build square law detectors, rf detectors, millivoltmeters, attenuators, power and VSWR meters, loads, filters, and more.

MOTOROLA'S IMPEDANCE MATCHING PROGRAM - A Mini Review

By Harry, W3IIT

Gary, WA2OMY, told me about this PC compatible computer program available from Motorola Semiconductor that I believe many club members will find to be very useful. It is written for the design of RF power amplifiers but is useful in solving any impedance matching problem that you may have. It includes a file of Motorola devices and you can add the impedance that you want to match to or match from for devices that are not in the file. The great thing about the program is that it includes a Smith chart that shows exactly what is happening to the network that you are planning to use. You can select any combination of series or parallel capacitors or inductors or transmission lines. The program shows the schematic of your circuit with the circuit values. When you switch to the Smith chart display, you can "tweek" the circuit to see what happens when you change the value of any circuit element. The return loss is also shown on a table on this screen. You can play games to see what may happen if any component value changes. The program states that a VGA monitor and a 286 or higher processor is required but I found that the program works fine on my ancient XT clone with a VGA monitor. It's slow but it gets there. When you see the Smith chart with all of it's details on the monitor you will see why a VGA monitor is required. The program is very impressive, it will allow you to play and learn and it's free. The following text is extracted from the readme file on the disk. The disk should be available from your local Motorola Semiconductor office.

Motorola's Impedance Matching Program, by Dan Moline, is a specialized form of CAD program specifically developed for RF power amplifier circuit design. It provides a simple environment for entering and analyzing impedance matching circuitry. Commercially available programs include a multitude of circuit elements and provide numerous analytical capabilities. However, MIMP focuses only on impedance transformations. This is typical of most RF power amplifier design problems; since, data sheets for RF devices present only large signal impedances; representing a single combination of frequency, voltage, power level and power dissipation. These impedances must generally be transformed to another set of impedances (50 ohm or the input/output impedance of another device). To do this, MIMP includes a standard library of passive circuit elements; including various combinations of capacitors, inductors and transmission lines in both series and shunt configurations. It also contains a unique, distributed capacitance element that models a capacitor distributed along a transmission line.

The real nucleus of MIMP is its computer aided SMITH Chart. It is uncommon for CAD programs to incorporate the benefits of manipulating actual impedance transformations on a Smith Chart. If commercially available programs were used for merely impedance matching, a typical final result of a computer run would be: S11 vs. frequency. To supplement this, many RF designers still keep a SMITH Chart, compass, straight edge and pencil handy so they can pictorially represent each circuit component's contribution to the total transformation. MIMP's Smith Chart facility provides this service ... electronically. It also displays each circuit element's contribution to the total impedance transformations. Simply stated, it is an electronic form of a standard, printed SMITH Chart. Some of the unique features of the SMITH CHART DISPLAY SCREEN include:

a) The SMITH Chart can be instantly 're-normalized' to any characteristic impedance. All impedances (with interconnecting arcs) are automatically recalculated and redisplayed.
b) There is an option for overlaying constant Return Loss circles for any complex source impedance; independent of the normalized characteristic impedance. (Most programs constrain the use of constant return loss circles to the center of the SMITH Chart).
c) Multiple transmission line transformations (each with different characteristic impedances) are displayed simultaneously and in exact graphical relationships to each other; independent of the SMITH Chart's normalized impedance. (Drawing transmission line transformations by hand requires an iterative denormalize /renormalize /replot/redraw procedure).

MOTOROLA'S IMPEDANCE MATCHING PROGRAM - A Mini Review Cont'd

d) A tabular impedance display is provided to view the impedance at any 'node'.
e) Constant 'Q' arcs can be added to the SMITH Chart.
f) Real time changes in the impedance transformation are displayed while individual circuit elements are tuned. This utility is provided to perform manual circuit optimization. A scalar display of Input Return Loss is updated simultaneously as an additional tool for optimization.

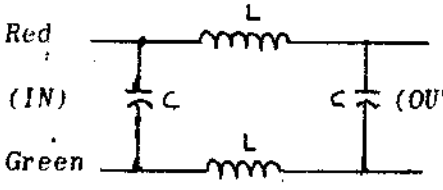
I'd like to include the full description but it takes 5 pages which is more than we have space for. If you have a VGA monitor (or were looking for a good excuse to get one), get a copy of this program and make have some fun doing real work and learning something at the same time. Don't expect to be able to move the design right from the printout to a finished design. The program only tells what will happen with a model of the circuit. Real devices have variations in characteristics and distributed capacitance and temperature effects not taken into account in your model will rear their ugly heads.

GETTING THE BUGS OUT OF YOUR PHONE

By Chuck, WA3IAC

Receiving RF from your telephone can be a big job. From my tests using my 2 meter rig, I found that Pi network configuration filters worked the best and provide better isolation than just using chokes or toroids in each side of the line. Chokes alone do work giving around 25 to 30 dB of attenuation. Split-cores give about 3 dB for two turns to about 18 dB for ten turns of phone line. This also depends on what frequency you are trying to attenuate. However, using the pi-filter shown below will give better than 40 dB of attenuation from HF to VHF.

This was the filter that saved my marriage! If you are running more power than say 100 watts then you may have to use more sections, but start with this one first. I used a phone type box about 2.5 inches square to mount the filter and found that it worked if it was at the phone or at the wall outlet.



L=27 uH
C=.0022 uF
at 200 v.

CHEESEBITS SUBSCRIPTIONS

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Subscription Rate: $10.00 per year (USA), $12.00 (Canada), $15.00 (Worldwide)
March 93

Send to: SUBSCRIPTION/ADVERTISING MANAGER:
Bob Fischer, WB2YEH
7258 Walnut Avenue
Pennsauken, NJ 08110

A No-Tuning Power Fet Pre-Amp
by
John Regnault G4SWX

Introduction
After 5 years on EME with the same old pre-amp, I wondered whether it was time for a change. My old 2SK571 (aging GaAs fet) has done great service but I couldn't help that feeling that there might be a little more to my rising noise floor to the north-west (perhaps an out of band blocking problem ?). Having seen the designs using MGF1801 power GaAs fets in the 144MHz EME newsletter and measured several at the Martlesham VHF round tables I thought I would give one a try. Well it would have been fine to copy the published designs but I rather liked the idea of a pre-amp that didn't require any tuning, had a fantastic low noise figure and super dynamic range.
I looked at the designs of WA5VJB,WD5AGO and WA7CJO using both L/C and quarter wave input cavities but was put off by the fact that a quarter wave input makes the pre-amp some 400-500mm long (longer than my masthead unit). These designs claimed fantastic low noise figure but still had all the usual tuning capacitors on the input lines, and in those tested at our round tables, unremarkable dynamic range.

First Bash
In some of the articles it was suggested that a length of low loss coax might work for an input line so I thought why not UT141 semi-rigid, you can bend it round the box! I didn't want to use a tuning C so I decided to try just using a line on its own. Not knowing any other parameters I calculated a quarter wave for 145MHz (velocity factor UT141 = 0.694) tapped the input at 19% of the length to give a similar gate impedance to the WA7CJO design, and built the pre-amp shown in Fig1.

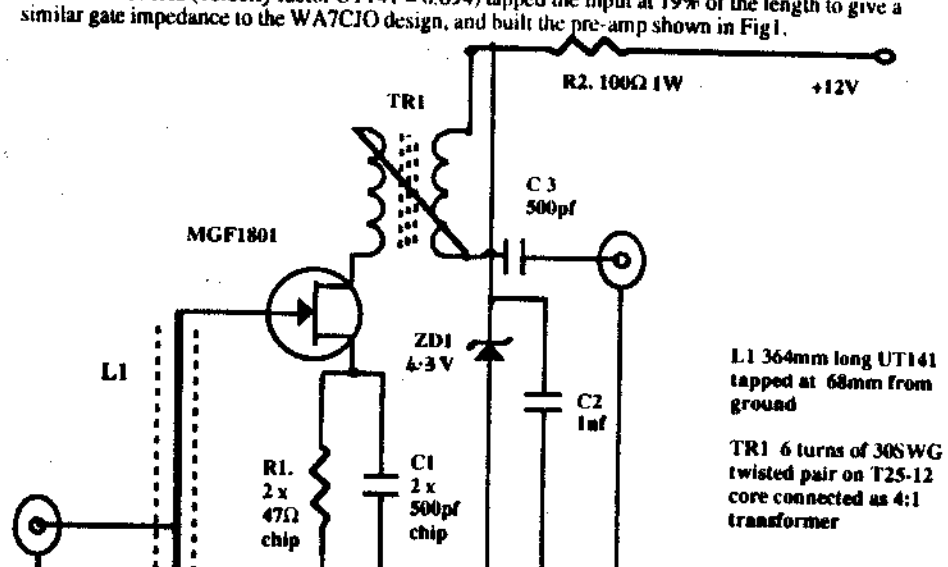


Fig1. First Attempt at a No-Tune Pre-Amp

On the output I used ferrite bead on the drain lead followed by a 4:1 broadband transformer(6 turns 30g bifilar wound on a T25-12). After I had thrown it all together, I rushed into a lab during lunch time and wow !
On 144MHz 24dB gain, 0.45dB noise figure with NO TUNING.
Tried bending the input line - no effect on noise figure....great.
Now for the bad news:
The 3dB bandwidth was about 15MHz, representing a loaded Q of about 10, but there was gain from

60 to 700MHz including 16.5dB gain and 0.85dB NF at 432MHz!!!!!!
The 3rd order input intermodulation intercept point was only -1dBm, reasonable, but poor when y consider the 65+mA @ 2.75V running in the device.

Thinking Cap
Well I didn't want a dual band pre-amp, but if you think about it all of the published quarter wave designs will have this three quarter wave resonance (including those from W5). I also wanted to increase the loaded Q of the input circuit to reduce the bandwidth so why not tap the fet gate down line ? Even better, let the line length from the gate to the top of the line be an open circuit quarter w at 432MHz and kill the three quarter wave resonance. I also moved the input tapping down by a si ratio in order to keep the input transformation the same. These modifications should reduce the 3d bandwidth to ~8MHz, get rid of the 70cms response whilst hopefully keeping the rest of the performance the same. This modification is shown in Fig.2.

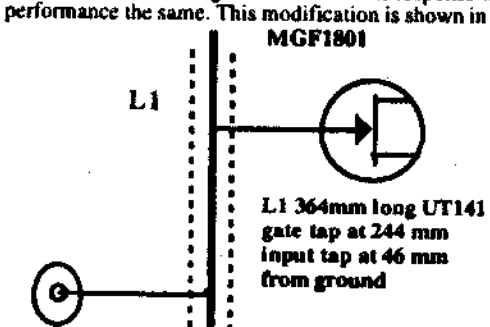


Fig2. Modified Gate Circuit For Higher Loaded Q

Well it all worked out as planned but, the noise figure had gone up to 0.74dB.
Ouch ! What had I done wrong ? Well by tapping the gate down from the top of the line I had chan the reactive part of the impedance on the gate and moved away from a noise matched condition. (For very low noise figures both the real and reactive components of the gate input impedance mus optimised.) If I had been using a tuning C with a shorter line I might have been able to effect some improvement to this.
Other configurations were tried including varying the input tapping point, but all produced higher N pre-amps. After a lot of cutting and hacking I discovered that the original configuration was the one produced the lowest bandwidth whilst maintaining a minimum noise figure!
As a final experiment I replaced the UT141(3mm) line with RG401 (6mm semi-rigid) to reduce the input loss as far as I could. The result was a reduction of 0.1dB in the noise figure to 0.34dB, a ve respectable figure (G4HUP's MGF1801 pre-amp with a conventional silver plated L-piston C inpu measured 0.29dB at the same time).

What Dynamic Range ?
A third order input intercept point of -1dBm for a device running 180+mW is CRAP.
What did I do wrong? I measured the 1dB gain compression point, it was +9dBm output, that suggested that all was not well with the device matching.
The 4:1 output transformer and 2.75V Vds don't help. Many other designs use such configuration have even seen an impedance ratio of 16:1 used and measured -10dBm 3rd order input intercepts! quickly reconfigured the transformer to a 1:1 ratio, to give a drain load of 50Ω. On re-testing I discovered that the NF hadn't changed, even by 0.01dB, the gain had dropped as expected, but onl by 1dB. Mindful of the G3WDG preamplifier design that takes the output in parallel with a 50Ω resistor, viz. 25Ω drain load, I decided to go further. I reconfigured the same transformer, to give n 1:4 ratio on the output. I lost another 4dB gain but still had almost 20dB left, so that wasn't a probl The output power as expected went up, the 1dB gain compression point was now +11dBm or 12m The third order input intercept now stood at about +5dBm.
Well there was more to go, Not thwarted by the power dissipation I set about to vary Vds and meas NF. Between 1 and 3V Vds the noise figure is at a minimum, raising Vds to 6V increases the NF b about 0.1dB. At 5V Vds the 1dB compression point had gone up to +15dBm or 30mW, with the in

ntercept point +6dBm. The limiting factor now became the input matching. Lowering the gate
npedance would increase the 3rd order interception point but now we would certainly sacrifice NF
ad we would increase the pre-amp bandwidth. Can you really use this extra output power ??
settled down at 3.75V Vds as a happy figure that suited a 5.1V zener diode(1.25V source auto-bias).
ote that I have current limited the drain supply by using a resistor/zener combination, if these devices
ke off they can easily become 1/2W oscillators! Watch out for your mixer !!!
he circuit of the final version of the pre-amp is shown in Fig3.

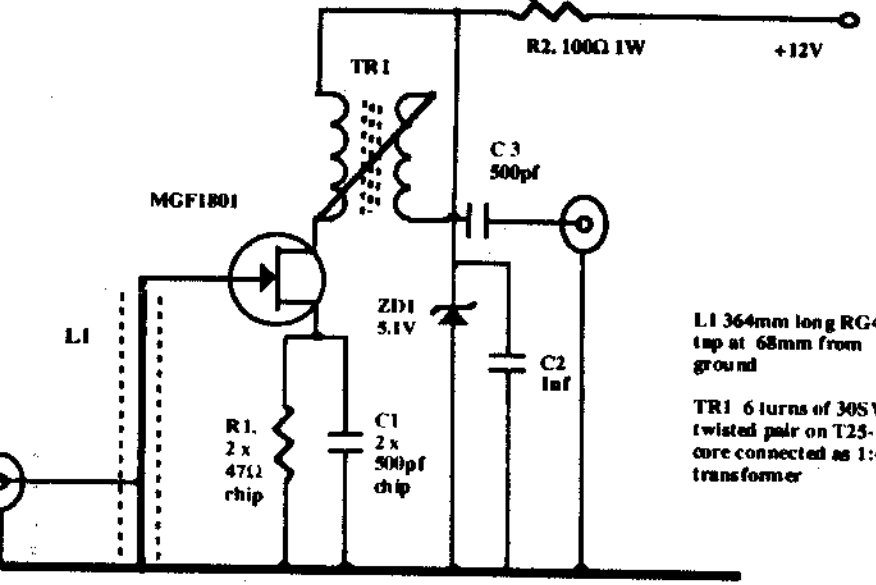
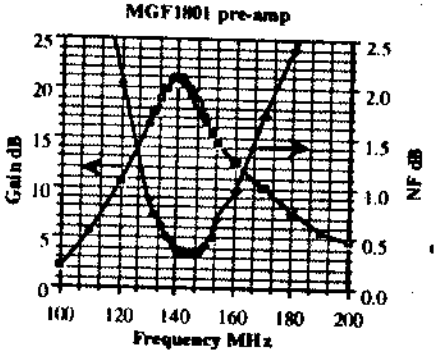


Fig3. 144MHz MGF1801 Pre-amp

in and NF plots of the final version of the pre- amp are shown in Fig4.

nstruction
of the prototypes were constructed using the 'Ugly Bug' method onto a piece of copper circuit
rd. The source circuit was made up of two 47Ω surface mount chip resistors and two 500pf surface
unt chip ceramic capacitors. They were mounted on their ends with one R and one C per source
d. The fet was mounted on top of this source circuit. A ferrite bead was threaded over the drain lead
ore the transformer connection to improve stability by reducing the microwave gain. The copper
er and PTFE dielectric were stripped for 2mm for the gate connection. The copper outer of the line
oldered to the board close to the gate connection. The input tapping was obtained by carefully filing
4mm, 180° slot in the copper outer and soldering an SMA connector to the line (outer connection to
line copper outer). The input can then be bent to reach the relays directly.

planations
lower than expected reduction in gain, 1dB for the first X 4 reduction in drain load, can be easily
plained; at high values of load the device will exhibit gain saturation, hence the
gm x Rl relationship no longer holds. Reducing the drain load should also help amplifier stability,
he prototypes seemed stable at most values of input impedance)



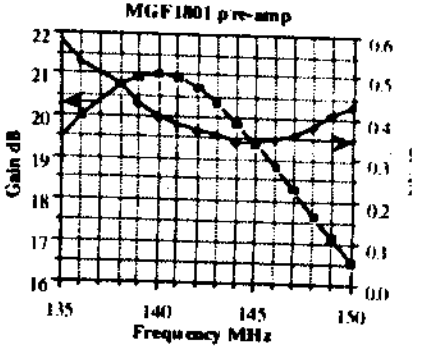


Fig4. Gain and NF Plots for MGF1801 Pre-Amp

Several other pre-amp articles have cited narrower bandwidth as a benefit of using a high unloaded Q input but use the same circuit. As the impedance ratio from the 50Ω input to the top of the tuned circuit/gate is the same in each case, the loaded circuit Q will be the same (this assumes that unloaded Q > loaded Q(typ 10)). Therefore for the same circuit configuration, raising the unloaded Q of the input circuit will not change the bandwidth. It will however reduce the input losses and hence reduce the NF. I am sure that even the RG401 input line can be bettered but I find it hard to see the true NF being lower than 0.25dB. Changes in gain, caused by changing the input circuit, are so small that they are difficult to measure and probably will be masked by gain compression effects anyway. I am also not sure that reducing the bandwidth further would keep the design as reproducible. As you can see in Fig4. there is only about 3MHz of minimum noise bandwidth.

All of the quarter wave cavity designs will have a significant response at three times the design frequency unless special precautions are taken (as I tried) to avoid it. Such preamplifiers may not be suitable if simultaneous multi-band operation (as on field days) is undertaken.

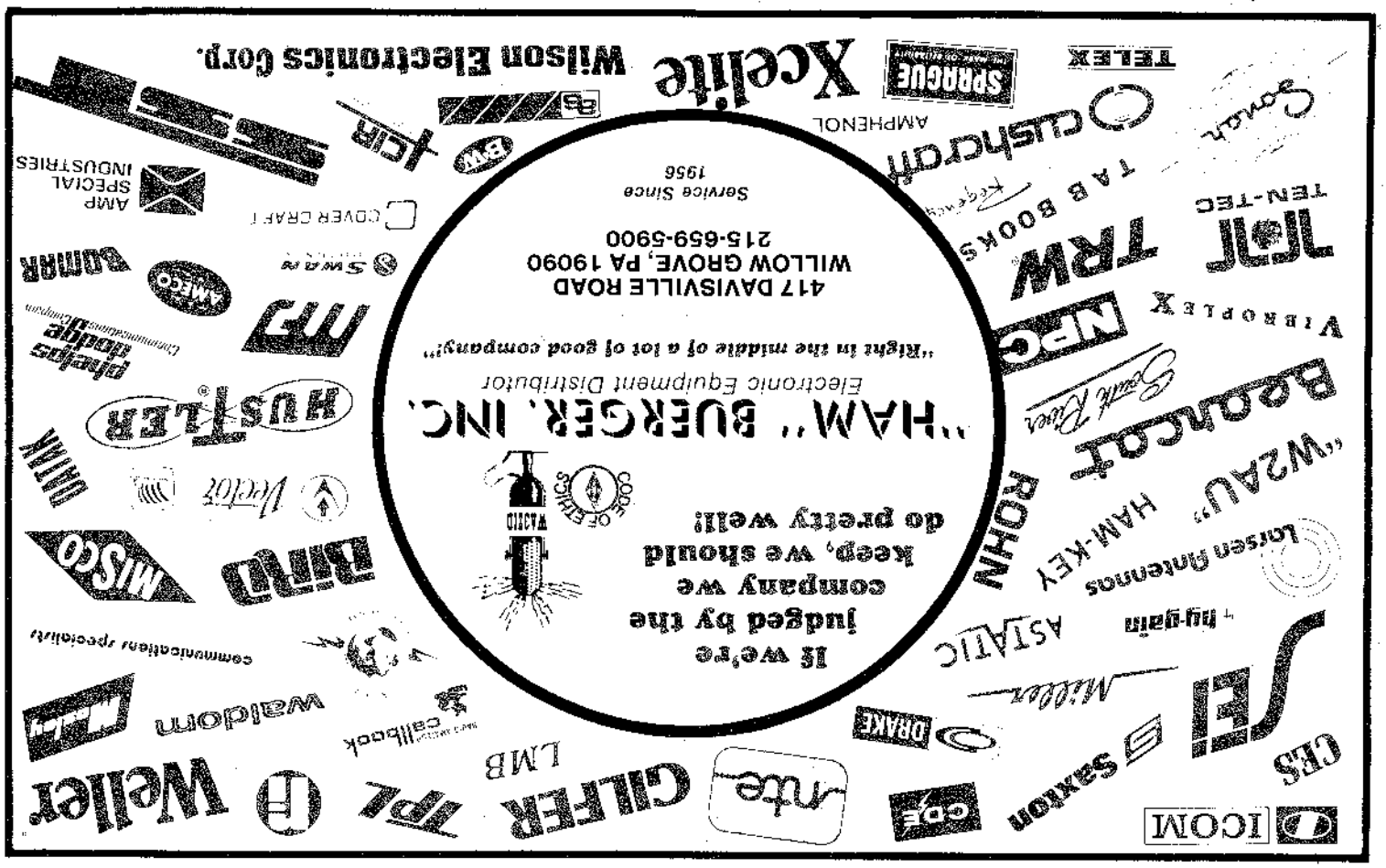
Further Comments
This design has only been tested with MGF1801 fets and semi-rigid coax. Experimenting with other devices and tuned lines may give different matching, noise minimum frequencies etc. These notes are provided so as those without the test gear can exactly duplicate the design, and it will work. I have described the agonies in order to help the experimenter develop these ideas further.

The input return loss of the pre-amp has been measured at 0.5dB. All I can say, is at least it has return loss, rather than the return gain mentioned in other articles. I think that it will take a very clever designer to produce an ultra low noise, narrow bandwidth pre-amp with a high input return loss !

Other articles have claimed fantastic low noise figures, I have seen 0.1 dB banded around. I would suggest extreme caution be taken by anyone running a NF testing clinic at amateur events. These NF measurements were made on regularly calibrated HP noise figure test sets with 5dB ENR noise heads, they were then checked on two independent systems. A slight miss-calibration of the head ENR figure or using a 15dB ENR head gave noise figures in the 0.1dB order. Take note of the comments of DJ9BV and others, low NFs are very difficult to measure, especially with such high input reflection.

Final Result
Well I am pleased. This pre-amp needs no tuning, the noise figure is very good and the dynamic range is very competitive. Shame about the bandwidth but that can easily be put right by a good filter in front of the next stage. I now wonder if it all was worth while... probably!
As to what's next, I think it will have to be at the other end of the system !!!!!

Bouquets
I would like to thank Dave G4HUP for setting the competitive pace, Sam G4DDK for his advice and winding me up and Andy G4PIQ for helping with the measurements and his accompanying sarcasm.



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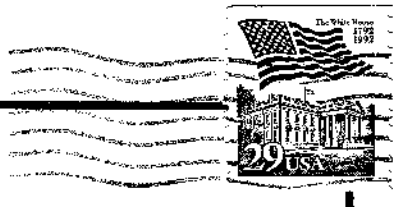

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