H.A.R.S. Journal
Journal of the Hereford Amateur Radio Society

Issue No 19 • April 2019

Editorial (Iss 19)

The recent 100% increase in the Club membership fee was met with just a little derision from some of the members. Raised from £5 to £10 for 1 year, the increase was deemed by the committee to be really excellent value for money when considering the increased expenses of that members special “radio/ATV night out”. The *Journal* is also working hard to support the club by additional revenue generated through advertising.

AGM 5th April

A grand gathering of members made for a good evening. It was good to see Paul and Heather down from Telford, who both together had a strong wish to get involved with the very strong contesting group which we have… I believe they have just been inducted! Ed.

The Journal joined together with the club members in saying goodbye the Derek our Chairman, who stood down after two years sterling service. Thank you Derek.

Almost at the throw of a switch, so to speak, we all watched as Nigel, with applaud, pomp and ceremony, winged his way delicately across to the exalted Chairman’s seat, as the newly elected top-dog (so to speak again!). Nigel had new ideas already penned down and there was speculation that he had prior knowledge of this whole affair because his chairmanship was already cited on the “procedures list”… inadvertently it was later claimed. Welcome and best wishes Nigel.

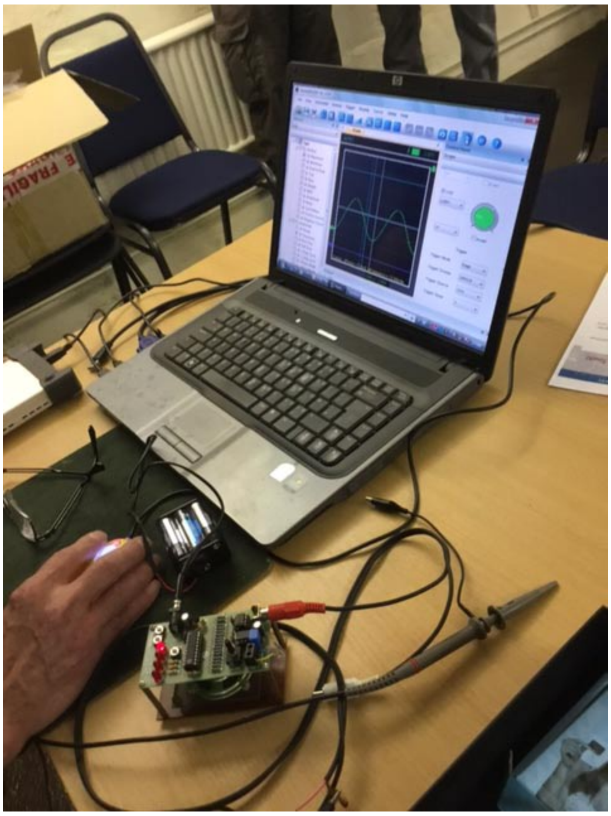
Welcome and good wishes too, to our new committee member Tristan Quiney M0VXX.

…Ed

New member W0OF

Giles G0NXA, brought along new member “Jack” (W0OF). Here he is being nudged for his membership fee by Derek G3WAG!

Sid & Charlie



20MHz 2-Channel Oscilloscope

by Duncan M0OTG

Club night March 1st Duncan gave all of us the chance to see how a laptop PC can be turned into an accurate oscilloscope using the " Hamtech Oscilloscope" converter available on eBay price £50.

There are various models to choose from, with a maximum top frequency of operation ranging up to 100MHz. The Unit demonstrated maxed out at 20MHZ. For calibration-check purposes, an accurate 1KHZ frequency is available.

The measuring about 8" x 5" x .75"high, it is connected into the laptop via the USB port. Basic waveform data/parameters are digitally displayed along with the waveform which can be a square-wave, trapezoidal or sinusoidal OR, a combination of everything. And DC voltage of course.

Why not use one to check the purity of your CW waveform up to and including 14MHZ?

Thanks Duncan… wonderful …Ed

HARS radio equipment available for loan to Club members or for purchase

The following list of equipment is available for loan to Club members. The loan period is 3 months and members wishing to use the equipment will have to sign a simple agreement which covers the loan terms. If you wish to borrow then please contact Duncan (Hon Sec) M0OTG.

- Grid Dip Meter MFJ-201
- Buddipole 10-40M portable antenna with tripod and carrying case.
- Yaesu FT450 All bands to 50MHz. Needs a 12V PSU
- Pixie 7MHz QRP kit. Needs assembling.
- Baofeng UV-5R 70cms/144MHz hand-held complete with accessories.

Go portable with the Buddipole! …Ed.

US Navy finds ham radio training makes "workers better at their jobs"

(Source: Southgate ARC via Mike K8RAT)

Can learning amateur radio make for better engineers and software developers?

Writing in C4ISRNET – Electronic Warfare, Eric Tegler says:

When a group of [US] Navy engineers and software developers took time away from their day jobs in December, they spent the time pursuing a task long considered passe: they became licensed amateur radio operators.

Some 23 employees from Naval Air Warfare Center Weapons Division (NAWCWD) took a week-long class in amateur radio at Point Mugu, California culminating with an FCC amateur radio license test. All passed and are certified at the "technician" level for amateur radio operation [permitted 200 watts on some HF bands, 1500 watts above 30 MHz].

Now, Navy officials say the move may make the workers better at their jobs. The staff gained an understanding of radio frequency (RF) propagation that's essential to what they do, said Brian Hill, electromagnetic maneuver warfare experimentation lead and collaborative electronic warfare supervisor at NAWCWD.

This was originally from 2E0RJS

Hill, who earned his amateur radio license in high school, noticed that while most of his department's recent hires had degrees in computer science, many had little background in RF theory or operation.

"You can explain antenna patterns and concepts like omni-directional vs directional using Smith charts, but it's helpful to add a demonstration to really convey the concept," Hill said. "You can explain modulation as a concept, but for a demo… let them listen to how modulated digital signals with audio frequencies sound… For those who never knew the joy of hearing a 2400 bps modem connect over a telephone line, it was a new concept!"

These concepts are central to electromagnetic maneuver warfare.

"We need to be able to have awareness of all threats and opportunities from [zero frequency] to light within an integrated system," Hill said. "Our adversaries are looking at the entire spectrum to use against us, and we need to do the same. Having awareness of how the atmosphere changes from daylight to night and how that affects propagation of [high frequency] is important."

This can be critical for young developers/engineers whose experience is typically limited to the UHF/EHF-based systems now in vogue across communications, guidance and ISR technologies.

Read the full story at https://www.c4isrnet.com/electronic-warfare/2019/02/06/can-learning-ham-radio-make-for-better-engineers-and-software-developers/

…Ed.

Screen shots from es'hail 2

Hi guys,

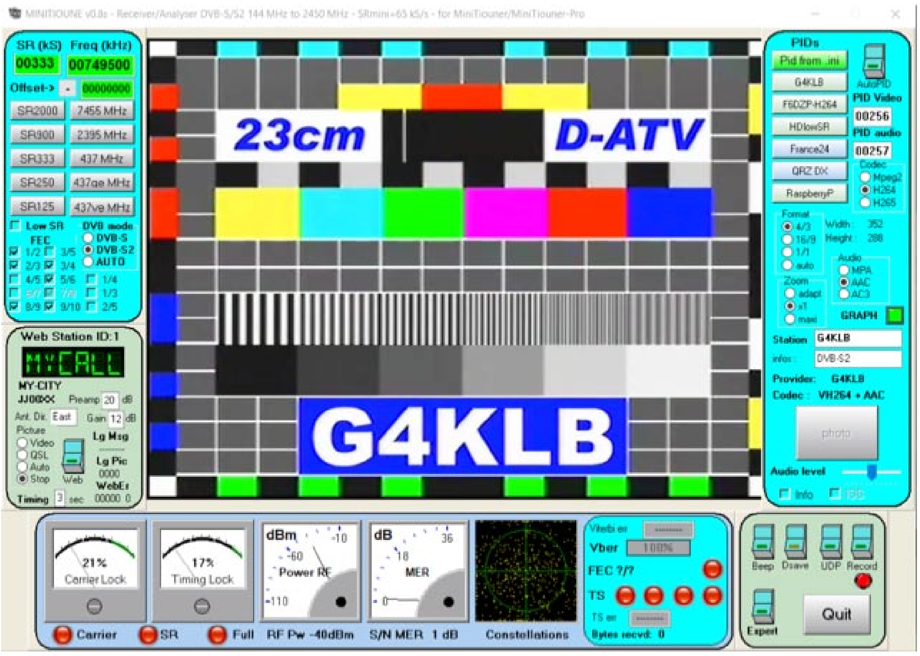
Just thought you might like to see some amateur TV pictures received today by John from the new geostationary satellite eS'Hail 2. These are taken opf course from the 8MHz wideband transponder.

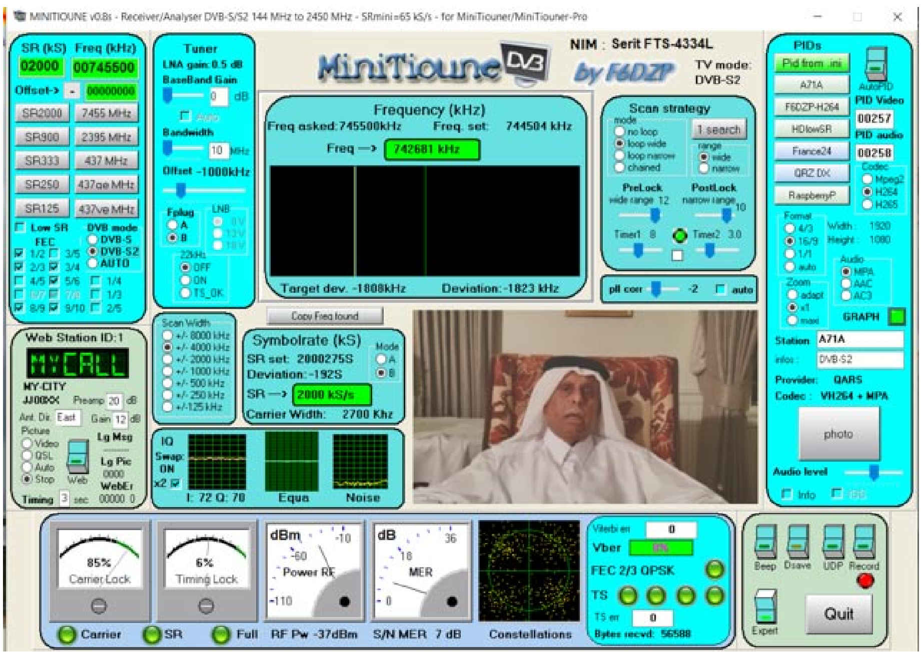
The pictures show two shots of G4KLB's transmission being displayed using the normal screen of the software package which controls the (home built) receiver.

Also included is a shot from the beacon transmission which for the time being is a permanent reliable signal to help amateurs whilst setting up their equipment. This shot is displayed using the 'expert' screen of the software which has many more controls available.

Hope you like the pics.

73
Allan G3RDC and
John G3YQC





Foundation Licence Course No15 "Successes 17th Feb"

L - R: Josh M7JMF, Phil M7ADT, Alan M7AJA, Jon Stannard M7RSD, Kirsty M7OLO, Xander M7XEL, David Newman M7KAN Billy M7WJA, Harriet Parkinson M7HLP (Photograph by G8BPN)

David Redmayne took the AL exam at the same time as the last foundation licence and is now M0WJA

Internet 'RF' Gateways

Internet radio gateways simply use the internet to join together repeaters or simplex stations using the latest voice over internet protocol (VOIP) technology. The three most popular ones in the UK being eQSO, Echolink, and IRLP.

Your radio signal is received by the local gateway, converted to digital and relayed via the internet, converted back to audio, and retransmitted by the remote gateway in another part of the world using VHF and UHF equipment throughout.

Good or Bad for Amateur Radio?

Amateur Radio means different things to different people. Some like to see how far they can get very often under stressful conditions. Others like to develop technology or just look forward to meeting and making new friends across the world.

Love it or hate it, internet VOIP "linking" adds something new to the hobby. Using dedicated repeaters and dedicated frequencies the system opens up amateur communications to those who cannot instal large aerials. And in some cases provides a solution for those who cannot operate normally at all due to TVI, planning regulations, basement QTH – to name a few obstructions.

...Ed

CAT Cable for the FT817ND

Richard Fox 2E0FDA

Dear Club Members

I recently purchased a CAT cable for my Yaesu FT 817 ND.

Made by a company called Technofix in Wales, it came with an excellent software CD which contained idiot proof instructions and the relevant drivers.

I've been using it with 'ham radio deluxe' and all facilities work fine, remote control of the rig, waterfall display, and bandscape, all displayed on a laptop.

PS been using the Weller soldering stations a lot and they're fantastic.

PPS busily making aerials. Wouldn't have been able to do this without so much support from the club.

Thanks Richard ...Ed.

Fibre Optic Tx/Rx Devices Covering 200MHz – 5.5GHz

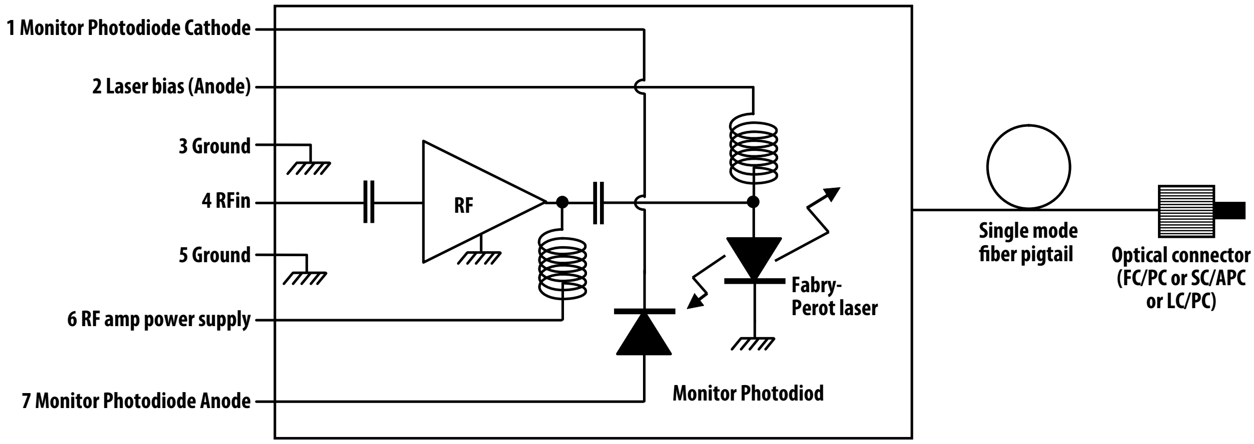
Avago Technologies have produced these two components which when used with fibre can transfer RF emissions over great distances using intensity modulated light.

Transmitter AFBR-1310Z.

https://docs.broadcom.com/docs/AV02-3184EN

This transmitter uses single-mode 1310nm fibre to pass the analogue 200MHz – 5.5GHz frequency range. Parts designated AZ use SC/APC pigtail whilst BZ parts use an LC/PC pigtail which are flex SIP headers which can be inserted into a receptacle or soldered directly onto a circuit board.

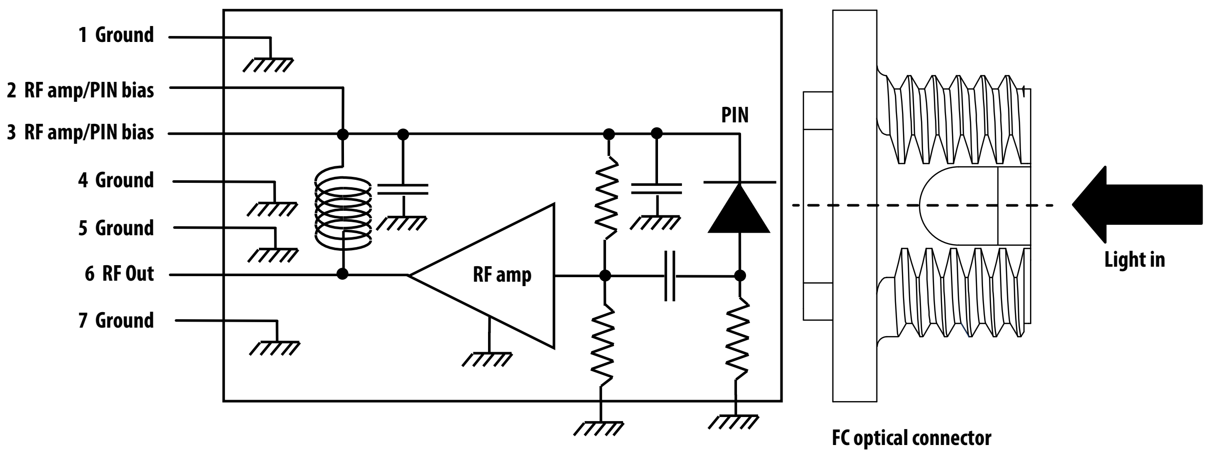
The transmitter input is to a 5V linear (50 ohm) RF amplifier which is coupled to a Fabry-Perot laser. Precise loop control is maintained using the integrated floating monitor photodiode that permits a choice of operating level.



Receiver AFBR-2310Z

https://docs.broadcom.com/docs/AV02-3183EN

This corresponding receiver requires 3.3V. It is optimised for 1310nm but will operate over 800nm to 1600nm light frequency range, the complete colour spectrum. It is interesting to note that the wide-band nature of this receiver means that the spectrum can be split into 16 channels (20nm spacing). Each channel can be separately modulated which in this case is “intensity” modulation.



These devices are beginning to get scarce. The TX is available from Farnell (2393444) at £60. The RX is available on Amazon at £64.

Warning: Do not work with lasers using power levels above those quoted in the data sheets without proper eye protection.

...Ed.

Make ham radio a habit

By Dan Romanchik, KB6NU

Every week, I get an email newsletter from Penguin Random House called *Signature*. *Signature* includes links to articles about books and writing. Being a writer, I clicked on the link to "5 Good Writing Habits You Need to Learn Now." As I was reading the article, it occurred to me that the advice could also apply to amateur radio.

So, with apologies to the author, Lorraine Berry, here are five things you can do to make ham radio a habit:

1. ***To get on the air more, or to do more building, set up a time to do it.*** If you enjoy getting on the air or homebrewing, but never seem to be able to find the time to do it, you need to put it on your schedule. Set aside the time a couple of days, or a week, or even a month in advance, and you'll be more likely to do it. If you set up a regular time every week, pretty soon it will be a habit.

2. ***If ham radio is important to you, create an environment that encourages you to do ham radio.*** To make ham radio a habit, you really need a place that's set up to do ham radio. If you have to dig out and set up your equipment every time that you want to get on the air, you're just not going to do it. You need a "shack" that makes it easier for you to engage in the hobby. Richards, K8JHR, gave me some great advice back in 2012 on where and how to set up a shack (https://www.kb6nu.com/building-a-new-shack/).

3. ***Create temptations that reward you for your new habit of ham radio.*** For me, being able to make interesting contacts, or building some new gizmo, is reward enough, but you may want to reward yourself with a beer or some ice cream after an operating session.

4. ***Make it easy to do what you like to do.*** This is related to #4. Your shack should have everything you need to easily do whatever ham radio activities you enjoy doing. If you enjoy operating, then it should have a nice operating desk. If you enjoy building, then set it up so that all of your tools are readily accessible. The easier it is to do, the more likely it is that you'll do it. If you enjoy operating portable, then build up a kit that has all the stuff you need, and have it ready to go when you're ready to go.

5. ***Start with the Two-Minute Rule for new habits and continue from there.*** The "two minute rule" (https://www.lifehack.org/articles/productivity/how-stop-procrastinating-and-stick-good-habits-using-the-2-minute-rule.html) is a tool to help you overcome procrastination. The idea is to allot just two minutes to a task that you'd like to complete or a skill that you'd like to develop. It's a small commitment, but enough to get you started, and the idea is that once you're started on a particular task or project, continuing work on that task or project becomes a lot easier. Those two minutes could easily become a half hour or an hour once you've gotten the ball rolling.

Armed with this advice, I'm expecting you to be a more active ham in 2019. I'll be listening for you on 40 m.

Thanks Dan …Ed.

Dan Romanchik, KB6NU, is the author of the KB6NU amateur radio blog (KB6NU.com), the "No Nonsense" amateur radio license study guides (KB6NU.com/study-guides/), and one of the hosts of the No Nonsense Amateur Radio Podcast (NoNonsenseAmateurRadio.com). His wife sometimes thinks that amateur radio has become too much of a habit for him.

A Microwave Oven FM ATV Transmitter

Adaption of a commercial Microwave Cooker as a Microwave Transmitter. By Bill Parker, W8DMR.

A MICROWAVE OVEN FM ATV TRANSMITTER

Bill Parker W8DMR

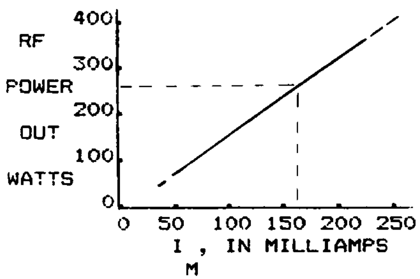
A 450-Watt microwave oven delivers about 250-Watts of RF at a frequency of some 2400 MHz. This seems a very useful power to have easily available. Such a device therefore cries out for a way to utilise its power for amateur TV. A video modulator must be added and some power supply changes made in order to make it suitable for TV, but it has been done. This article discusses how this may be achieved and shows a typical circuit diagram with construction notes, which it is hoped will assist the would-be experimenter.

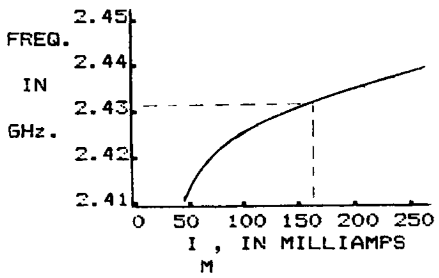
Anyone experienced enough to have a go at such a project hardly needs reminding of the danger of the high-level radiation produced by such an appliance. So DO BE VERY CAREFUL what you are doing and put safety above all other considerations. If in doubt DON'T even try it.

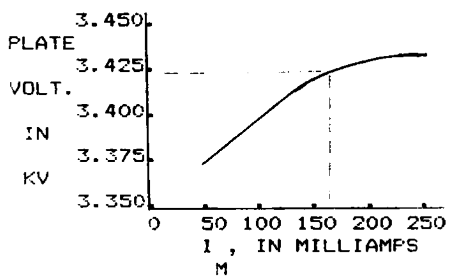
GENERAL DESCRIPTION

A microwave oven magnetron is a self-contained cross-field power oscillator. Built-in cavities largely determine the oscillator frequency, however the actual plate voltage and strength of magnetic field around the magnetron also effects the frequency to some degree. Experimental tests indicate that a maximum usable frequency swing (for modulation purposes) of around 20MHz is obtainable.

MAGNETRON PARAMETER GRAPHS



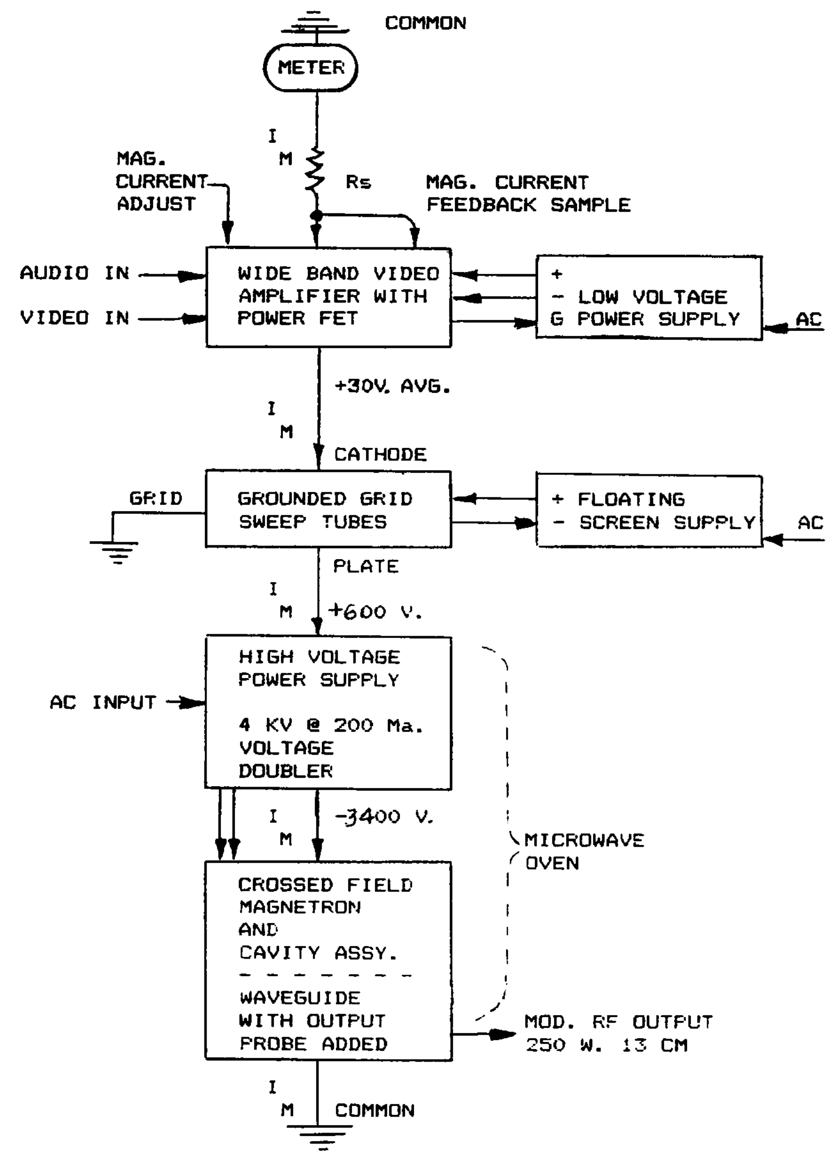


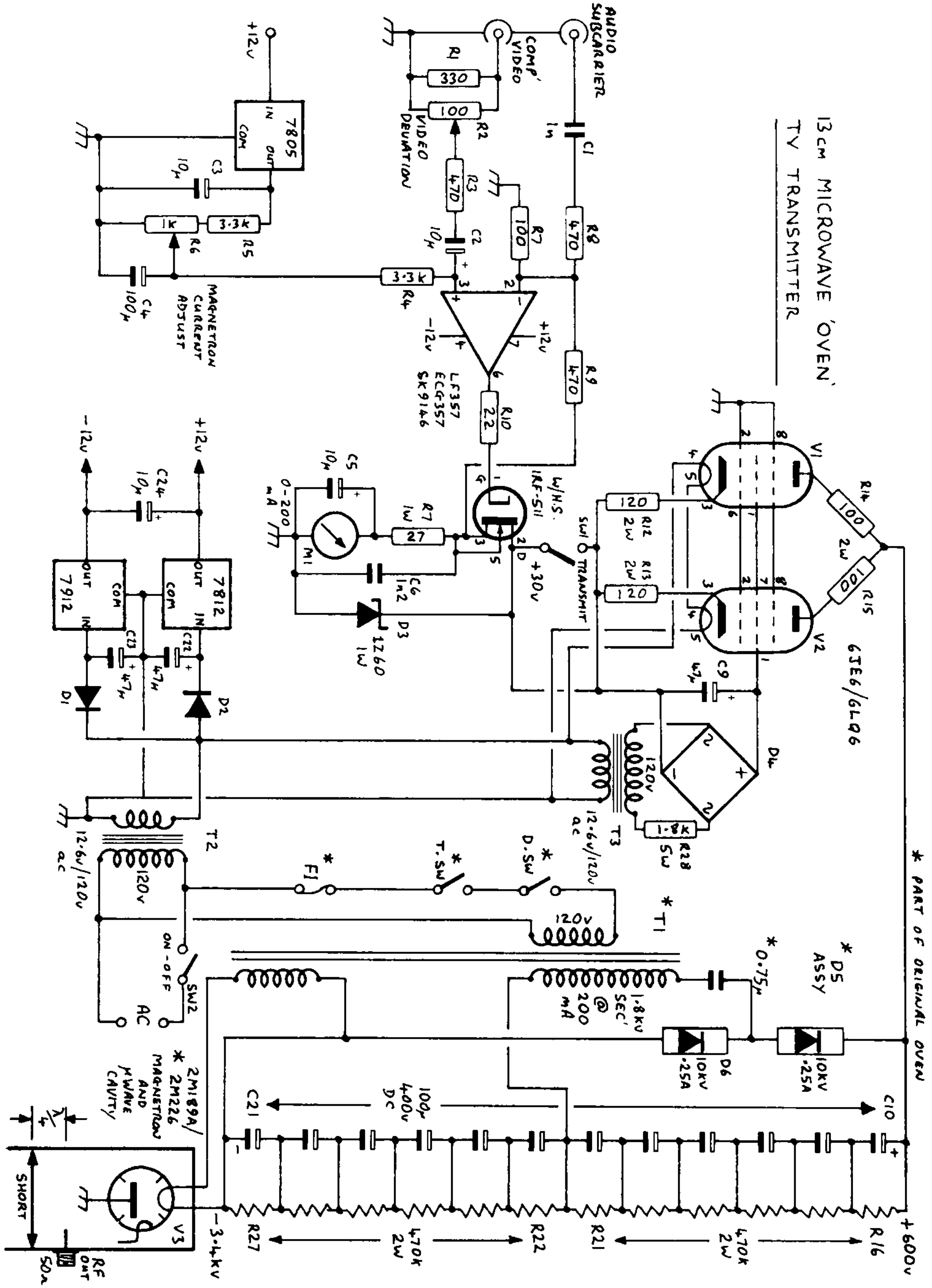


NOTES:

1. FOR 2M189A MAGNETRON.
2. CAVITY MODIFIED W/SHORT.
3. Z LOAD = 50 + J0
4. SEE TEXT FOR SHORT INFO.

BLOCK DIAG. – MICROWAVE ATV XMTR





The coefficient of frequency change is about 0.1 MHz/mA of magnetron current. Because of linearity considerations FM TV is probably the only way of modulating a magnetron effectively.

The video modulator is a bit unusual and is shown in the block diagram. It functions as a high-voltage CURRENT source of high open-loop gain that can set the magnetron current to a known value. This establishes both the operating frequency and power output.

The unit of transconductance is the SIEMEN (formerly MHOS). Transconductance is the reciprocal of resistance; for volts in, the modulator provides current out. It is essentially Ohm's Law inverted: MHOS = CURRENT/VOLTAGE. The video modulator has a transconductance of 0.2 Siemens.

The transconductance amplifier must provide enough bandwidth to amplify all of the video modulation components, and if an audio subcarrier is used the bandwidth required is 6 MHz. A capacitor and resistor (C6 & R27) is used to extend the high frequency response from approximately 4.5 to 6.0 MHz. A video pre-emphasis circuit is still required for FM use.

The screen supply for the two sweep tubes must float above ground. Only the magnetron plate current must be allowed to enter the current source control loop as the controlled variable. The screen current should not be included.

The waveguide circuit must be modified by adding a shorting partition or plate. This is analogous to a 1/2-wave coaxial stub or a 1/4-wave when a reflected path provides twice the distance. Wave fronts, in either case, are phase shifted by 180 degrees. The shorting plate causes the reflected wave to be in phase with incident wave from the magnetron. The E-field probe is inserted where the RF voltage maximum occurs. Normally, the length of the output probe is a 1/4-wave for maximum power output. Shortening the output probe introduces a reactive component to the output port of the magnetron. After an undetermined number of degrees of rotation within the magnetron feed structure, the magnetron cavities cause the operating frequency to be lowered by about 25MHz. This helps ensure operation within the amateur 13cm band.

CIRCUIT DESCRIPTION

The +5v regulator U2 provides a voltage reference. It's divided by R5 and 6 and connected to the non-inverting input of wide-band op-amp U1, establishing a current reference. The output of U1 feeds the gate of Q1. The output of source follower Q1 is sent to R9 and, through R7 provides negative feedback to the inverting input of U1. The feedback ratio is calculated as follows:-

$$\text{FEEDBACK RATIO} = \frac{R9 + R7}{R7} = \frac{470 + 100}{100} = \frac{570}{100} = 5.7$$

At equilibrium Q1's drain-to-source current produces a drop across R11 that is 5.7 times U1's non-inverting input voltage. Control R6 sets the drain current in Q1 that is proportional to the non-inverting input of U1. The plate and cathode current of V1 and V2 in parallel are one and the same, if screen current is not considered at this time.

The voltage on the drain of Q1 increases or decreases until the control grid of V1 and V2 changes the cathode bias to Ik = Id = Is. V1 and V2 form a grounded grid voltage amplifier with unity current gain. V1 and V2 have sufficient current capacity to serve as a current source for the magnetron. Actually a transconductance amplifier is formed with the high value of 220,000 Microsiemens (0.2 Siemens). The value can be calculated by solving:-

$$S = I/V = \left(\frac{R9 + R7}{R7}\right) \times \left(\frac{1}{R11} + \frac{1}{R9 + R7}\right) = 0.22 \text{ Siemen}$$

Transformer T3 provides a non-grounded +100v screen supply for V1 and V2. R28 limits the screen dissipation. The screen floats above ground because only the plate current (Ik = Im) should enter the control loop by way of V1 and V2 cathode, and is the control parameter (less the screen current).

Components R14 and 15 help provide current sharing in V1 and V2. Zener diode D3 protects power FET Q1. Resistors R16 - R27 serve as voltage equalising as well as bleeder resistors. Regulators U3 and U4 provide +/- 15v for the op-amp. Magnetron current is metered by M1.

CONSTRUCTIONAL DETAILS

Actual construction will depend upon the exact brand and model of microwave oven, however, certain general information applies: First, inside the oven, cut off the waveguide which connects to the cooking cavity flange. A waveguide shortening cover needs to be made to cover the feed port to the oven chamber. The size of this port is typically about 1.5 x 3 inches. A piece of 18 to 22 swg copper around 3 x 5 inches will do nicely. Drill 16 to 20 holes around the outer edge for mounting holes and, of course, an equal number of matching holes will need to be drilled around the open waveguide port in the oven. Sheet metal screws or machine screws with nuts will provide a good shorting partition for the open end of the waveguide.

Next, an E-field probe for the output needs to be constructed. Using an N-connector, solder a piece of about 0.175 dia 5/8 inch long brass tubing to the connector. Solder a brass nut to the other end of the tubing. Insert a 1/2 inch brass screw into the nut, this forms a tuning adjustment for the probe. Make sure the screw is fully inserted and is a snug fit. Now a hole must be made in the waveguide to accept the probe. The hole is drilled in the top of the waveguide from outside the oven. It mounts 1 5/16 inch from where the waveguide cavity shorting partition was added. It should also be centered in the waveguide.

The filament leads to the magnetron are bypassed by 2000pF feedthrough capacitors, the ground side of each must be opened and care should be taken not to damage the insulation of the filament wiring. The capacitors are usually white oval shaped ceramic. by drilling out the four rivets the ground is removed. Simply push the capacitors back into the tube housing 1/8 inch or so.

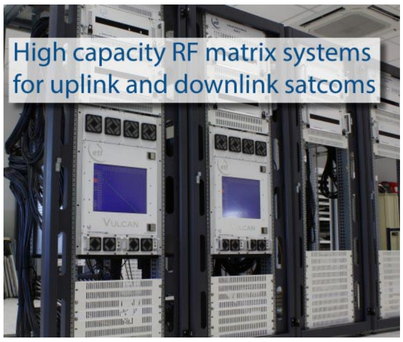
SAFETY CONSIDERATIONS: Radiant energy above a certain level can be harmful. Use an inexpensive microwave leakage detector (available from TANDY stores etc) to verify the safety of the finished ATV transmitter. Readings from any surface in the unsafe or red zone indicate a leak which MUST be corrected. DO NOT point a microwave aerial emitting RF power levels in the class of this transmitter at people, buildings or use in residential areas. Use common sense and DON'T test it on your pets. Currently a level more than 5 mW per square centimetre at 2400 MHz is considered hazardous.

REFERENCES: 1) RF Design magazine, design award, Dave Pachlok - p24-25, July 1988
2) Microwave oven ATV transmitter by D. Pachlok at Indiana UHF & ATV meeting, 14th Jan. 1989.

Acknowledgement is made to ATCO NEWSLETTER vol.6 number 1.

PARTS LIST — M.O. ATV XMTR

ITEM	QTY.	DESCRIPTION
1.	1 EA.	MICROWAVE OVEN, 400-500 WATT WITH 2M189A OR 2M226A MAGNETRON
2.	2 EA.	TV SWEEP TUBE, 6JE6C/6LQ6C
3.	12 EA.	CAPACITOR, ELECTROLYTIC, 100 MFD/400V
4.	1 EA.	DIODE, HI. V. RECTIFIER, 10 KV, 250 MA.
5.	12 EA.	RESISTORS, 470 K OHMS, 1 OR 2 WATT
6.	1 EA.	TRANSFORMER, 12.6 VAC, 3.0 AMPS.
7.	1 EA.	TRANSFORMER, 12.6 VAC, 450 MA.
8.	1 EA.	METER, 0-200 MA. USED OR SURPLUS
9.	1 EA.	CONNECTOR, N-TYPE, FEMALE, CHASSIS MNT.
10.	2 EA.	CONNECTOR, F-TYPE, FEMALE, CHASSIS MNT.
11.	1 EA.	IC, LF357, WIDE BAND OP-AMP
12.	1 EA.	IC, REGULATOR, 7812
13.	1 EA.	IC, REGULATOR, 7912
14.	1 EA.	IC, REGULATOR, 7805
15.	1 EA.	TRANSISTOR, POWER FET, IRF-511
16.	2 EA.	DOIDE, LOW V. RECTIFIER, 200 V., 1 AMP.
17.	1 EA.	DIODE, BRIDGE ASSY., 400 V., 1 AMP.
18.	1 EA.	DIODE, ZENER, 68 VOLT, 1 WATT
19.	1 EA.	CAPACITOR, CERAMIC, 0.001 MFD.
20.	1 EA.	CAPACITOR, ELECTRO., 10 MFD., 25 VOLT
21.	2 EA.	CAPACITOR, ELECTRO., 100 MFD., 10 VOLT
22.	1 EA.	CAPACITOR, ELECTRO., 330 MFD., 10 VOLT
23.	1 EA.	CAPACITOR, POLY., 1200 PFD., 100 VOLT
24.	1 EA.	CAPACITOR, CERAMIC, 0.1 MFD., 50 VOLT
25.	2 EA.	CAPACITOR, ELECTRO., 47 MFD., 160 VOLT
26.	2 EA.	CAPACITOR, ELECTRO., 470 MFD., 25 VOLTS
27.	1 EA.	RESISTOR, 390 OHM, 1/4 WATT
28.	1 EA.	RESISTOR, 100 OHM, VARIABLE, PANEL MOUNT
29.	3 EA.	RESISTOR, 470 OHM, 1/4 WATT
30.	2 EA.	RESISTOR, 3.3 K OHM, 1/4 WATT
31.	1 EA.	RESISTOR, 1.0 K OHM, VARIABLE, PC BRD.
32.	1 EA.	RESISTOR, 100 OHM, 1/4 WATT
33.	1 EA.	RESISTOR, 22 OHM, 1/4 WATT, 5 %
34.	1 EA.	RESISTOR, 27 OHM, 1.0 WATT, 5 %
35.	2 EA.	RESISTOR, 120 OHM, 1.0 WATT, 5 %
36.	2 EA.	RESISTOR, 100 OHM, 1.0 WATT, 5 %
37.	2 EA.	RESISTOR, 470 OHM, 1.0 WATT, 5 %
38.	1 EA.	SWITCH, POWER, 125 VAC, 0.5 AMP.



Employment opportunities at ETL Systems

ETL Systems are based at Madley where they design and manufacture RF distribution equipment. The Company have several positions available for software/firmware engineers. Also, positions available for production technologists and pcb design personnel. Apprenticeships too!

If you would like to consider joining this worthwhile Company please contact them direct on 01981 259020 or if you wish to discuss with me (Mike) first of all, then please email journaleditor@herefordradioclub.uk or call 01432 272987.

Club Personalised Merchandise

All items have your callsign and club details. For availability and prices please contact Peter Lawley M6YPL or journaleditor@herefordradioclub.uk

T Shirt

Cap

Mug

An exotic China version is available.

Articles Wanted!

Please think about submissions/projects you might like to send in or see.

General topics and key words are listed below.

Members projects	Events	Training
Members station	Notices	QRP/QRO
Construction	Help	Illustrations
Items wanted	News	Photographs
Items for sale	DX	Early radio
Hints and kinks	Militaria	Restoration...

... or anything else that you think might be of interest to HARS members. If you have an idea for a submission, but don't know how to present it, I will do it for you.

Please submit anything and everything to journaleditor@herefordradioclub.uk or talk with Mike at the Club meetings.

73s es GDX, G3LZM
Mike Bush (Editor)