

**Chairman:** Derek Gillett G3WAG • **Treasurer:** Ben Elms-Lester MOSWV • **Secretary:** Duncan James M00TG  
**Committee:** Dave Porter G4OYX, Bob Bowden G3IXZ, Matt Porter G8XYJ *Contest Captain*, Mike Bush G3LZM,  
Tim Bridgland-Taylor G0JWJ, Geoff Wilkerson G8BPN, Adrian Hartland G8IVO, Richard Webb M0RPW

## Oh Yes, Some of Us have Other Interests!

Do we recognise the man in the picture?...of course we do. Its Grant G4ILI. Grant's passtime (next to amateur radio) is motorsport. With Grant's permission, I have much pleasure telling you something about it.



The car in the pic is a historic F2 Brabham BT21 from 1968. It has a twin cam Ford motor producing 180bhp, the car only weighs 420Kg.

The Brabham is one of three cars in which he competes, the others being a historic Formula Ford Lotus type

61 from 1969 and a 30 year old Porsche 911.

The photos were taken at Shelsley Walsh hillclimb near Worcester. Grant is a regular there and at many other sprint and hillclimb venues throughout the UK doing about 15 events a year between April and October. His international events take place in France and Australia and he is visiting the latter soon, to take part in two events driving a works sponsored MG3 hot-hatch.

MG is now owned by the Chinese by the way!

## Editorial

The new web-site is up and running at [www.herefordradioclub.uk](http://www.herefordradioclub.uk). The new concept is of course, about our amateur radio hobby but it is also intended to illustrate the social nature of the club too.

One or two things need to be added, to make the site complete however.

We have already had commendations about the site and it has already proved to be a useful portal for employment, and members "items for sale". Do visit the latter if you need something or have something to sell, or if you need new RF connectors, for example. All issues of the *Journal* are also available.

### Hereford University

Soon Hereford will be a fully fledged University City! The new facilities will be concerned with engineering and technology and the student cohort will begin in 2020.

It will be lovely to have an influx of young active people into the City. The age group is 18 – 24 year olds and I expect they will bring new themes and organised vitality. It is likely that some will be contacting the Club...we should keep this in mind.

*Ed*

Having competed in classic rallies, multi-day endurance events, and single day events, you can imagine that he has many trophies

Grant's wife Pam travels too and is very much a team player being involved and supportive, working as "pit crew".

Pam's son races in a Lotus, and his wife also races in a Mazda MX5 and as Grant says, it can be a truly family affair sometimes with three cars running!

*High Octane Grant ...Thanks, Ed.*

# HARS does 144MHz Trophy

By Steve G1YBB

Hi all,

As most know several club members have been up Clee Hill in Shropshire all weekend competing in the (apparently) world's largest 144MHz contest, which runs across the entire Region 1 for 24 hours.

More on the event to follow, but some great thanks in order.

In no order, as they say.

- Richard for providing his palatial caravan and beers and beverages and biscuits.
- Clive for organising and providing our main food supply. We were NOT roughing it on the food front.
- Adrian for sorting and fetching the generator.
- Andy for his caravan, biscuits and jaffa cakes. Also for the sanity restoring SWR meter.
- Phil for bringing and erecting the shack tent and second tent.
- Tris for saving the day with the site.
- Adrian (IVO) for other sanity check and reassurance.
- And the whole team for making it a very successful club weekend of radio.

We already know where we lacked, but we had some massive positives.

Attached is a sample picture of the station antennas.

Would everyone on site who took pics be so kind to email me the full size images please to collate. I would keep email size down to 10meg, send as many as you need.

A final point.

As all know, we are as a club in a commanding lead in the year long UKAC series. It's ours basically to hold on to now.

But this weekend's contest is part of another year long series, the VHF Championship. Our Dave ASR has been extremely active in this and as a result, HARS are only 300 odd points from leading that too. We're hoping that two big entries plus a few support entries may tip that balance. There is one more event I believe in that.

I think it would be rather cool for HARS to win that too, don't you think?

73 Steve

*Thanks, Steve ...Ed.*

*Don't forget to send in  
your best DX successes!*

editor@harsjournal.com



## Talk on Astro Radio Sources

By Dr David Morgan.

Many, many thanks David for coming to our Society to introduce us to the radio emissions from galaxies far, far away. It is possible to use the equipment that many amateurs already have, if one takes great care to build suitable antennas, to listen in, we were told!

Karl Janski way back in 1931 wrote an article called "Radio from the Milky Way" and so is credited with the discovery of cosmic radio signals in the frequency range 160-480MHz, at that time.

David explained that the dominant sources in the radio sky are the sun, supernova remnants, radio galaxies and the Milky Way. The Sun's radio emissions are easily monitored whilst other sources are eight orders of magnitude weaker in signal strength thus, the sophistication of the equipment needed varies considerably. Standard communications radio receivers are adequate for listening to the Sun's solar bursts but special temperature controlled "stability" receivers with low noise front-end pre-amplifiers, are needed to detect

galaxies. Other radio interference and ground noise have to be overcome and nullified.

A sophisticated amateur set-up with a parabolic antenna diameter 2.3 metres could record signals from the most powerful radio sources in the Universe. The list is not long and it varies depending upon the working frequency which in turn, is based upon the physical characteristics of the object.

Some radio emissions are at "X" band (8-12GHz) among these sources include the Sun, the Moon, Orion Nebula, Taurus – Crab Nebula. Other objects emit at lower frequencies such as 1420MHz. Here we find the centre of our galaxy, Sagittarius A, Cassiopeia A and Cygnus A.

It was obvious from David's talk that radio astronomy is a fascinating area of technical endeavour and is open to people with some radio skill. It does not require vast expenditure as much of the equipment can be obtained from amateur radio stores or be home-constructed.

*Thank you David...a wonderful, engaging evening. ...Ed.*

## New Member Richard Fox

Our club welcomes Richard who has expressed an interest in obtaining transmitting license. Richard has a maritime radio license and is a marine engineer. He can turn his hand to anything mechanical as you can see from the photos. He built the narrow boat starting with the basic steel hull and it has lately been repainted and fitted with VHF radio. The NG speaks for itself...a beautiful restoration.

*Thanks Richard ...Ed.*



*It is a November Golf ("NG"), built from an MBG GT that was dead.*

*New chassis, MGBs were monocoque, body tub, wings, bulkhead and complete front end, with MGB mechanicals. The engine was completely rebuilt with +60 thou pistons. I recently drove it to Ludlow Food Centre and back and it performed impeccably. It can do 0-60 in 8.6 seconds, top end @100-110 mph but it gets there quick and has the handling and roadholding of any thoroughbred bespoke English sports car.*

## Success! 8th Sept Foundation Students



Left to Right: Keith Makin M6PQI, Leon Jones, Paul Klasmann M6PYK, Richard Fox M6PQG

Following a two day Foundation Licence Course over the weekend of 8th and 9th September the four candidates Paul, Richard, Leon and Keith were rewarded with a pass and so can now eagerly await their documents from the RSGB and apply for their licence.

Once again the HARS Training Team were on site at the Clubrooms to deliver the course.

In November the Team will be running an Intermediate Licence Course over three Saturdays and a Sunday and there is already a contingent of previous FL candidates who are enrolled on the course. Watch this space for further details or apply now and register an interest via the “training” button at [www.herefordradioclub.uk](http://www.herefordradioclub.uk).

## Not Forgotten

Ten years after President Kennedy vowed to send man to the moon, it finally happened. A marvellous achievement which involved 400,000 people and a technological leap embracing new innovations, the like of which had never been seen before.



50 years on (yes 50 years!) it seems that we have almost forgotten about the event. It was astoundingly remarkable because it was generally felt at the time, that America couldn't even make a reliable fridge!



*Viva the USofA ...Ed*

## Club BBQ

Phew! ....What lovely summer weather we had during June and July but some found it too hot and dry.

In the continuing good weather, on Sunday 5th August twenty-eight members and wives arrived at Hill House for a splendid BBQ. Twenty-eight was also the temperature at the time but the trees gave good shade to everyone.

Geoff lit up a range of grills and proceeded to barbecue chicken, sausages and beef fillets. Salads of all kinds were arranged on nosh-table 1 and a mixture of creamy trifles and a New York cheese cake (to name but a few goodies) were arranged on the "Sweet" table.....nosh-table 2.

The pictures show everyone enjoying the occasion and our host, Geoff, making sure that we all had a continual supply of meat options.

*A lovely occasion. Thanks Geoff ...Ed*



## Validity / Revalidation

Although the current amateur radio licence is known as a "licence for life", all radio amateurs are required to revalidate their licence at least every five years. This requires every licence holder

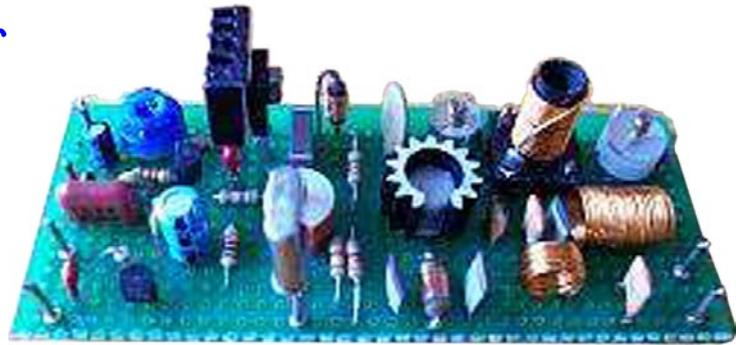
to contact Ofcom to confirm or update the details on the licence database.

The quickest way to revalidate is simply to access the licensing system and (re)-confirm your details online via the Ofcom website, or by email to [spectrum.licensing@ofcom.org.uk](mailto:spectrum.licensing@ofcom.org.uk).

# QRP AM(cw) Transmitter for the 20 meter band RE-TX02HF20

14 MHz (20-meter band) AM/CW QRP  
HF transmitter

by Guy, ON6MU  
Revision v1.4 (Sept 2018)



## About the QRP AM/cw 20-meter band transmitter

In this project, you will make a simple low-power broadcast-type circuit, using a crystal oscillator integrated circuit and an a collector modulated AM oscillator. You can connect the circuit to the an electrec microphone (pointed out in gray on the diagram) or amplified dynamic microphone (no amplified microphone has a to low output voltage to work. Approx. 100mv is needed). You could also add a LF preamp stage of one transistor to allow connecting a dynamic microphone directly.

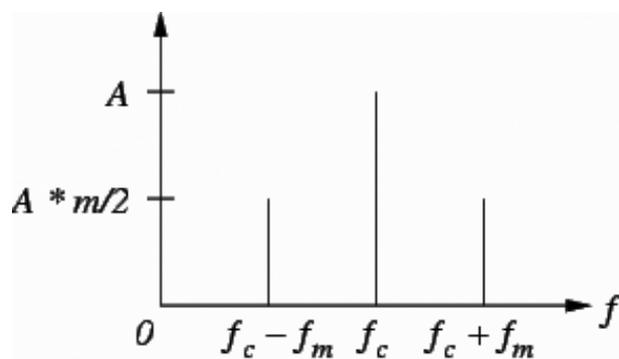
You'll see that you can receive the signal through the air with almost any AM radio receiver. Although the circuits used in radio stations for AM receiving are far more complicated, this nevertheless gives a basic idea of the concept behind a principle transmitter. Plus it is a lot of fun when you actually have it working!

Remember that transmitting on 20 meter band you'll need a valid radioamateur license!

A wide range of different circuits have been used for AM, but one of the simplest circuits uses collector modulation applied via (for example) a transformer, while it is perfectly possible to create good designs using solid-state electronics as I applied here (T2 BD135).

The transmitter is build as a Colpitts Oscillator with a strong 2N2219(A) transistor. HF-output of the oscillator is 400 to 600 mW, depending on the supply voltage of 10 to 15 Volts. The transmit frequency is stabilized with the 14.3Mhz crystal which can be bought in almost any electronicparts shop. A slight detuning of approx 2kc is possible by using C11 trimmer capacitor. The oscillator signal is taken from the collector of T2 by induction and via a low-feedthrough filter and guided to

the output via an L-filter circuit cleaning up the signal pretty good. The oscillator is keyed by T1 and the morse key (S). By keying the morse-key T1 is not been used for modulation and is biased, hence lets T4 freely oscillate.



The resulting AM spectrum using sinusoidal carrier and modulating waveforms.

## AM

Amplitude Modulation (AM) is a process in which the amplitude of a radio frequency current is made to vary and modify by impressing an audio frequency current on it.

This was the first type of modulation used for communicating signals from one point to another and is still the simplest to understand.

A radio frequency current has a constant amplitude in absence of modulation and this constant amplitude RF carries no information, i.e. no audio intelligence and is of no use to radio telephone (voice communication), but has application in morse code communication.

In its basic form, amplitude modulation produces a signal with power concentrated at the carrier frequency and in two adjacent sidebands. Each sideband is equal in bandwidth to that of the modulating signal and is a mirror image of the other. Thus, most

of the power output by an AM transmitter is effectively wasted: half the power is concentrated at the carrier frequency, which carries no useful information (beyond the fact that a signal is present); the remaining power is split between two identical sidebands, only one of which is needed.

### **CW**

CW is the simplest form of modulation. The output of the transmitter is switched on and off, typically to form the characters of the Morse code.

CW transmitters are simple and inexpensive, and the transmitted CW signal doesn't occupy much frequency space (usually less than 500 Hz). However, the CW signals will be difficult to hear on a normal receiver; you'll just hear the faint quieting of the background noise as the CW signals are transmitted. To overcome this problem, shortwave and ham radio receivers include a beat frequency oscillator (BFO) circuit. The BFO circuit produces an internally-generated second carrier that "beats" against the received CW signal, producing a tone that turns on and off in step with the received CW signal. This is how Morse code signals are received on shortwave.

Although this design is primarily designed for AM, it can be used for CW by keying S.

### **RF Oscillator**

Is been carried out by T4 (NPN 2N2219). This is the stage where the carrier frequency intended to be used is generated by means of Crystal Oscillator Circuitry or capacitance-inductance based Variable Frequency Oscillator (VFO). The RF oscillator is designed to have frequency stability (Xtal) and power delivered from it is of little bit more importance, although it delivers 600mW@12v, hence can be operated with low voltage power supply with little dissipation of heat. However, here we use the oscillator for a bit more power and so it does need a heat sink.

You could add a switch (very short connections if using an ordinary switch) to select different Xtal's (frequencies). You could also use a more effective diode-based switch I've build here. This hasn't got the problems with longer connections at all.

### **Filter**

RF power amplification is also done here and this stage is coupled to the antenna system through antenna impedance matching circuitry (L1/L2/L3). Care is taken at this stage so that no harmonic frequency is generated which will cause interference in adjacent band (splatter) on other bands (C17...C21). This 3-element L-type narrow bandpass filter circuit and a low-pass filter for the desired frequency cleans out any remaining harmonic signals very efficiently hence good spectral purity.

### **Modulator**

Is done by T1 and T2. Audio information is impressed upon the carrier frequency at this stage. Do to selective components circuits (C1,R1,R2,C2,C3,C4,C8) the voice component frequencies are enhanced, whilst others are suppressed (bandwidth +/- 3kc/side) keeping it between HAM-radio specs.

Why over modulation is not desirable?..

Over modulation is not desirable, i.e. modulation should not exceed 100 %, because if modulation exceeds 100 % there is an interval during the audio cycle when the RF carrier is removed completely from the air thus producing distortion in the transmission.

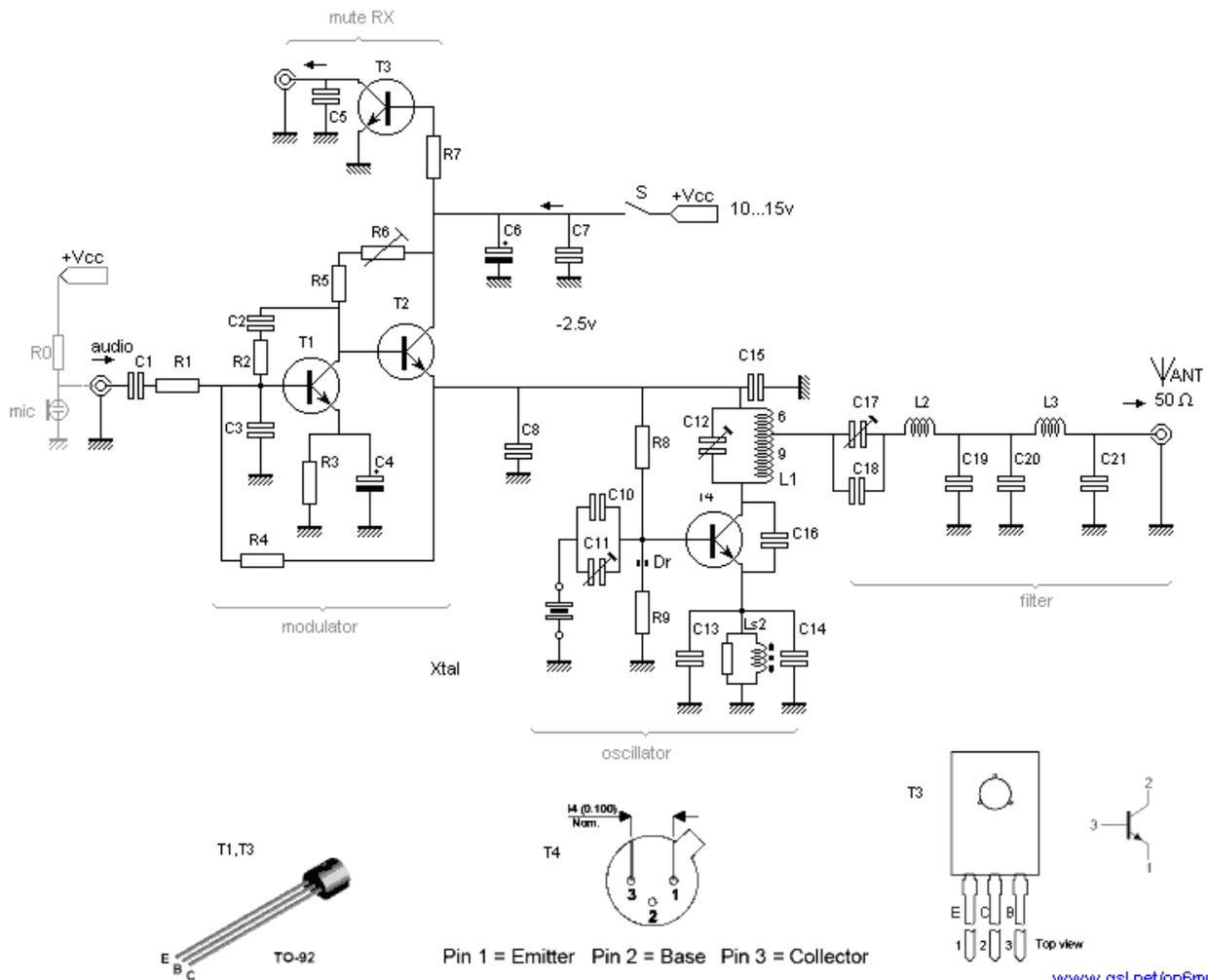
### **Housing/shielding**

The whole circuit needs to be mounted in an all-metal/aluminum case. If you're unable to obtain an all-metal case, then use a roll of self-sticking aluminum tape (available from your hardware store) or PVC box painted with graphite paint. Just make sure that all individual pieces of aluminum-tape (or the graphite paint) are conducting with each other. Works fine.

### **Use it with your receiver**

If you put a relay, or better a transistor switch to mute your receiver (if equipped) you can easily make a QSO HI. A simple BC338, Bc547, 2N2222 (T3) at pin a" with the base biased with a 100k resistor, emmitor at the gnd and the collector fed to your receiver's mute input works fine. Or you can use a 12v relay... Every time you PTT the transistor (or when using a relay, the switch) is "shortened" between the ground, hence muting your receiver (again; if your receiver has mute capabilities).

## 20-meter band AM/CW Transmitter, by ON6MU



Schematic for the QRP 20 meter band 14MHz HF transmitter / oscillator

### Parts list 20-meter band transmitter

T1 BC338, BC337

T2 BD135 (with heatsink)

T3 2N2222, BC338

T4 2N2219A (with heatsink)

C1 220nF (polyester) rev1.2

C2 1500 pF (polyester) rev1.2

C3 10nF (polyester) rev1.2

C4 47uF/25v

C5 100nF

C6 100uF/25v

C7 100nF

C8 100nF

C10 12pF

C11 120pF (frequency offset +/- 2kc)

C12 0...18pF (peek at design frequency Xtal)

C13,C14 330pF

C15 470pF

C16 47pF

C17 6...40pF (white) set at half position and tune to max power

C18 22pF

C19 180pF

C20 220pF

C21 150pF

R1 1k

R2 3k3

R3 120

R4 560k

- R5 560
- R6 500 (trimpot. to set power/modulation ratio: important for AM!)
- R7 100k
- R8 4k7
- R9 560
- L1 0.8mm Cul (insulated copper wire), 15.5 turns close together, 7mm inside, tap at 6.5 turns
- L2 0.6mm Cul (insulated copper wire), 24 turns close together, 8mm inside diameter
- L2 0.6mm Cul (insulated copper wire), 8 turns close together, 8mm inside diameter
- Ls2 470 1/2 watt carbon, 0,2 Cul turned 5 times over the entire length of the resistor (+/- 10uH)
- Dr small ferrite core with a few turns of 0,2 Cu (or the spare wire of R5 turned a few times through the core)
- 14.310Mc Xtal (or other for your desired frequency) +/- 2kc with C11
- C1, C2, C3, C8 polyester film capacitor



### Revision 1.1

Filter unit efficiency peaked by changing C19 & C20

BIAS T4 improved by changing R9 + adding ferrite in series

### Revision 1.2

Audio modulation spectrum and linearity improved (changing C1,C2,C3)

### Revision 1.3

Ls1 coil removed, C9 removed (extra choke was not needed)

### Revision 1.4

R6 increased to 500 Ohm to allow better control AM modulation depth

### Note:

Always use a dummy load for testing and adjusting the transmitter!!!

### Specifications

- Peak Frequency range: 14Mc...14.5Mc
- Output RF power: 600mW pep @ 12v (max modulation)
- AM modulated +/- 85% (CW if keyed)
- Adjustable output impedance to 50 Ohms
- Band-pass type harmonic L-filter + lowpass PII
- Usable voltages: Vcc 9 - 15 volts
- Average current I: 140mA@12v
- Xtal oscillator,
- Adjustable frequency of 2Kc
- LF input +/- 100mV @ +/- 4k

### Antennas

It's important to use a correct designed antenna according to band you would like to operate, or at least a good tuned antenna using a matcher (protecting your transmitter). Several examples can be found on my website and all across the Web. A dipole is always a good alternative (total length = 150/freq - 5%).

The performance (distance relative to you RF power) of your transmitter/transceiver is as important (if not more) as the RF power you transmit! A dummy load gives also a perfect 1:1 SWR, but you wont get any farther then the street you live in HI. Finally, athmospheric conditions (D-,E-,F-layers depending on the frequency you're using) is as important as all the above.

### Related

Remember that transmitting on the 20 meter band needs a valid radioamateur license!

Another related project:10 meterband transmitter project [users.belgacom.net/hamradio/schemas/transmitter\\_QRP\\_10meterband\\_on6mu.htm](http://users.belgacom.net/hamradio/schemas/transmitter_QRP_10meterband_on6mu.htm)

Taken from [users.belgacom.net/hamradio/schemas/transmitter\\_QRP\\_20meterband\\_on6mu.htm](http://users.belgacom.net/hamradio/schemas/transmitter_QRP_20meterband_on6mu.htm)

*A splendid construction article, Guy  
– thanks... Ed.*

# Digital Amateur Television

by Ray Hill; G0IMV (G6TSL)

Ray has introduced me to a DATV receiver he has built which is the first part of a complete TV transmitter/receiver system. The transmitter will be reviewed here in the *Journal*, probably at the next issue (17).

As you can see, the photos show an assembly which is neatness itself. Ray has used the wonderful British Amateur Television Club (BATC) for a little guidance and the “shop” for some of the specialised components.

The main PCB for the “Mini-Tiouner” ( V2.0) is designed by F6DZP who also designed the USB mini module. You have to obtain all of the components and indeed, some will have to come from the BATC shop. You have to be a BATC member to use the shop but if you are not a member, I am sure Ray will help out. Typical costs are the pcb £6, pre-programmed USB mini module £20, and the tuner sub-module FTS-4334LU/NIM, is priced at £27.

The next stage, building the digital transmitter; will be the construction of the Portsdown TX, as outlined on the BATC site.

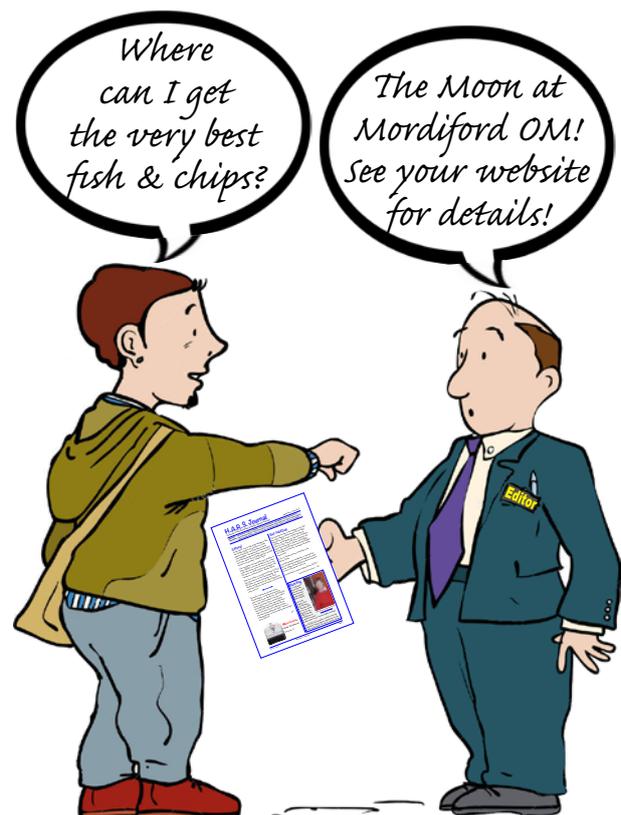
There are a number of DATV frequencies, 147MHz NBDTV, 1296MHz, 2300MHz and 10GHz (3cms). The latter can make use of a SKY dish. Filtering will be required except if using an LNB containing a PUCK circuit, another item available from the BATC shop!

In due course a club demonstration will be arranged where the expected quality will be of commercial/DVBS..., standard.

*Thanks Ray, looking forward to the next instalment. ...Ed*



## Sid & Charlie



## 3D printed parts for ham radio

By Dan Romanchik, KB6NU

One of the things that I keep telling myself that I need to learn how to do is 3D printing. This morning, I ran across a couple more 3D printing projects for ham radio that I thought I'd pass along.

The first I found on reddit: 3D Printed Parts for Portable Tape Measure Yagi Designs ([www.reddit.com/r/amateurradio/comments/963br3/3d\\_printed\\_parts\\_for\\_portable\\_tape\\_measure\\_yagi/](http://www.reddit.com/r/amateurradio/comments/963br3/3d_printed_parts_for_portable_tape_measure_yagi/)). The summary on Thingiverse ([www.thingiverse.com/thing:3042505](http://www.thingiverse.com/thing:3042505)), which is a website where "makers" share their designs, says:

These parts are made for use with 1-in. PVC pipe and 1-in. Harbor Freight tape measure steel. You can use electrical tape to attach the element holders to the side of the pipe, and use the driven element bridge to give structural rigidity across the driven dipole element. I have used this with up to 5 elements on 2m with good success. When not using the antenna, just pinch the elements to remove them from the holders, and store them INSIDE the tube! you can add some end caps to make this ultra portable. Use these parts with any of the multitude of tape measure YAGI design guides online.

Here's a look at an antenna made with these parts:

The element holders are attached to the boom with electrical tape in the photo above. While I haven't tried it, I'd suggest that the antenna might be a bit more robust if you could screw or perhaps glue the holders to the boom.

There are lots of other cool amateur radio 3D printing projects available on Thingiverse ([www.thingiverse.com/search?q=ham+radio](http://www.thingiverse.com/search?q=ham+radio)



&dwH=415b6d8da129c3c). Browsing through the list quickly, here are just two that look like they might be useful to me:

- Soldering Fingers ([www.thingiverse.com/thing:1725308](http://www.thingiverse.com/thing:1725308)). This project looks simple and quick.
- $\mu$ Bitx Case ([www.thingiverse.com/thing:2925336](http://www.thingiverse.com/thing:2925336)). I still gotta do something with the  $\mu$ Bitx I bought. This looks like it might get me started.

### Finally getting in gear

Last week, I attended a 3D printing class at our local maker space, All Hands Active ([allhandsactive.org](http://allhandsactive.org)), and now I feel like I can finally attempt a 3D printing project. I'm thinking about starting out with the simple Soldering Fingers project. If that goes well, I'll try a Raspberry Pic case and finally start using that in the shack. And, while these projects all seem pretty cool, I feel like I'm only scratching the surface.

Have any of you 3D printed anything cool for your ham radio projects? Is there another source of designs for ham radio 3D printed stuff besides Thingiverse?

When he's not 3D printing enclosures for his ham radio projects, Dan blogs about amateur radio, writes exam study guides ([www.kb6nu.com/study-guides](http://www.kb6nu.com/study-guides)), and operates CW on the HF bands. Look for him on 30m, 40m, and 80m. You can email him about your experiences with 3D printing at [cwgeek@kb6nu.com](mailto:cwgeek@kb6nu.com).

*Thanks, Dan ...Ed.*

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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 [editor@harsjournal.com](mailto:editor@harsjournal.com) or call 01432 272987.

## Club Personalised Merchandise

All items have your callsign and club details. For availability and prices please contact Mike G3LZM ([editor@harsjournal.com](mailto:editor@harsjournal.com)).



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, feel free to ask for advice.

Please submit anything and everything to [editor@harsjournal.com](mailto:editor@harsjournal.com) or talk with Mike at the Club meetings.

*73s es GDX, G3LZM  
Mike Bush (Editor)*