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Geoff Wilkerson G8BPN, Adrian Hartland G8IVO, Richard Webb M0RPW, Tristan Quiney M0VXX

Editorial

Hello ladies and gentlemen. I have rushed through this second “Journal” as a means of possibly lessening the mal-time which we are all experiencing at the moment. I hope it will provide some up-beat musing and maybe cause some creative thinking towards building lesser and affordable pieces of equipment... to communicate enjoyably with “home brew” pieces of equipment..., I am of course thinking mainly of the newly qualified members.

Up to date news!... have spoken to Bob Bowden (G3IXZ) on Monday and I have to report that in spite of his terrible fall, he is feeling much better and does expect to be able to get around without the use of a stick quite soon. Our hearts and love go out to Gwen Bob’s wife who has nursed Bob royally. Thanks Gwen, we love you.

I have included the trade kits from Waters & Stanton, for purchase if anyone has the time and motivation to take this course of action for pleasure.

IARU Ethics and Operating Procedures for the Radio Amateur.

We have an email from Hal MW7ISI which is intended as an introduction to the IARU document. Hal heads his missive as “Foundation Course Licence on-air Experiences” and of course addresses his comments to the HARS newly qualified.

We are very fortunate to have this Issue 2 document from the International Amateur Radio Union, with grateful thanks to John ON4UN and Mark ON4WW. There is no better complete work which outlines the code of practice and behaviour procedure befitting all Radio Amateurs young and old, new and not so new. There is a link to download it at the end of Hal’s article.

Thank you Hal ...Mike (Ed)

Local Net Times

Just a reminder that this evening Josh M0WYP, Tony M0VDO and I are hosting the Wednesday Lockdown Net on GB3VM (we have changed to this repeater as GB3ZA has a few issues at the moment). Starts at 2000 local time. GB3VM has good coverage up and down the A49, as well as over to the east and west.

GB3VM is at Wooferton Transmitting Station, it should get into most parts of Hereford City, although you will probably need an external vertical antenna.

Output is 145.6125 (-0.6MHz Split) and 103.5Hz CTCSS tone squelch.

This, of course, will run in conjunction with the 80M net that Tony is running on Saturday mornings from 0930 local time on around 3.77MHz.

73 Matt G8XYJ



**Coronavirus:
How amateur radio
is connecting people
during lockdown**

[https://www.bbc.co.uk/news/
uk-england-52442553](https://www.bbc.co.uk/news/uk-england-52442553)

External S-Meter on Icom Radios with CI-V Port

Add an external S-meter on any Icom amateur radio transceiver that has a CI-V control port.

Components



Arduino UNO & Genuino UNO × 1



Single Turn Potentiometer 10k × 1



Resistor 10k × 1



Resistor 4.75k × 1

Diode 1N4148 × 1



Capacitor 10 μ F × 1



Ferrite Core Round Cable × 2

Connector 3.5 mm (1/8) × 1

Connector Icom tuner (computer supply) × 1

Construction

This circuit uses an Arduino Uno or Nano to send a CI-V command to an Icom radio to ask for signal information, read the answer, convert it and display it on an analog output, where you can connect an analog (Arsonval) S-meter.

It is powered by the Antenna Tuner port on the Icom radio. If your Icom does not have a tuner port, you can use any other port or connector that provides a +12V output (at least 200 mA). An external DC power source can also be used.

If you don't have an Antenna Tuner connector, you can use a PC computer power supply connector, and trim it with cutters to fit the Icom tuner connector.



This project is designed for an Icom IC-7000 transceiver, but it can be adapted to any Icom radio with a CI-V port.

You can use the CI-V "00" universal address on some Icom radios, making this converter compatible with any Icom radio, without changing the CI-V address in the code.

Ferrites are installed on input & output cables to eliminate RF induction. The +12 V DC to the S-meter is not necessary; it could be used to power meter backlight or any other optional features.

The 10 k ohms potentiometer is used to attenuate the signal output (which is too high for most analog meters) and calibrate the analog meter to get a full scale reading with a powerful local signal (+60 dB).

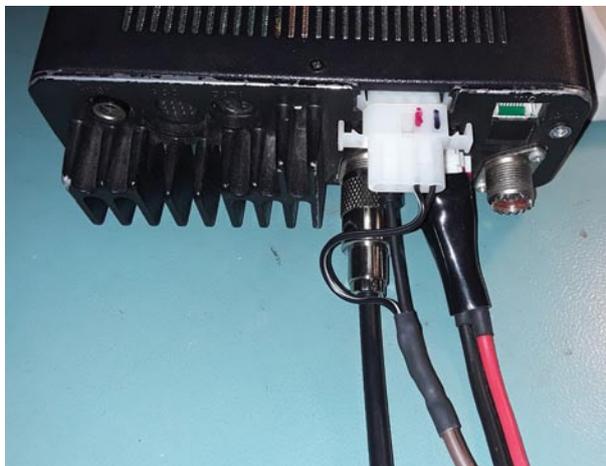
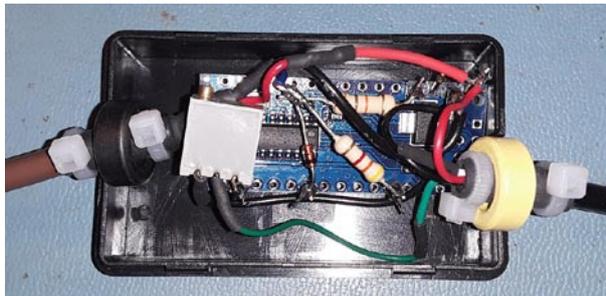
Some other similar projects, using Arduino as a CI-V interface:

<https://on7dq.blogspot.com/2017/02/ic-7300-paddle-or-key-easy-solution.html>

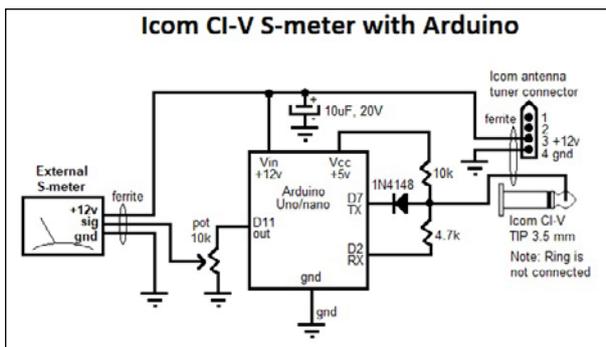
<https://www.qsl.net/on7eq/en/> Click on "projects" button

Custom parts and enclosures





Schematics



Continued overleaf...

Review: Fascinating FT8

FT8 is the relatively newcomer to ARD “Amateur Radio Digital” and is mainly in use by speedy CW operators and DX chasers. A QSO takes seconds and is just enough time for an operator to exchange abbreviated greetings, location (IO) and reports – would you believe 12 seconds!

Intended to catch DX riding out within volatile QSB conditions, it is used for communication for meteor scatter on 6m and various other difficult conditions up and down the HF bands. Uniquely, it can cope with signals at an extreme level of -60dbm... but only for very time-short periods. The whole experience is made possible by using bespoke WSJT-X software which can be run on Windows, on your PC, amongst other systems. An audio connection from the PC to your radio will be required and PC control of your radio.

To begin with, you need to ensure that your PC can hear the signals coming from the radio and that you can also send PC data signals to the radio via the speakers interface. Set the sound card input level on the radio to a fairly low setting. Set the speaker volume in the room to a fairly low setting and then set PC speaker volume manually when transmitting, to make sure that the ALC is not being triggered.

With the reception of signals, check your mic level on your sound card on your radio and adjust to ensure that the received signal on WSJT-X, is around -60dbm.

There are some audio settings which need to be entered in WSJT-X, to tell the PC which audio interfaces it should use. These are...

- RIG
- CAT CONTROL
- PTT

NOTE: For use with FT8 the PC clock has to be very accurate. You can use Dimension 4 (<http://www.thinkman.com/dimension4/>) which will keep your system clock in check.

...Ed

Code

Icom CI-V S-meterC/C++

```
// IC7300 Testbed for S-meter readout and other functions
// by Luc Decroos - ON7DQ/KF0CR
// modified & adapted by Daniel VE2BAP, 2018-12-01

#include <SoftwareSerial.h> // for comms to IC7000
#define BAUD_RATE 19200 // CI-V speed
#define TRX_address (0x70) // HEX $70 = Icom IC-7000
//#define TRX_address ((byte)00) // $00: Icom universal address (works for all radios).

// serial connection
// RX = Icom radio to Arduino : to pin 2 via resistor 4k7
// TX = Arduino to Icom radio : to pin 7 via diode 1N4148, with pull up 10k to Vcc (5V) on tip
// of 3.5 mm connector

SoftwareSerial mySerial = SoftwareSerial(2, 7); // (RX, TX)

int readCounter; // counts the number of bytes received from the radio
int sMeterVal1; // stores the most significant BCD byte containing signal info.
int sMeterVal2; // stores the least significant BCD byte containing signal info.
int sMeterOut = 11; // External analog S-meter connected to pin 11.

//-----
void setup()
{
  pinMode(13, OUTPUT); digitalWrite(13, LOW); // force LED (pin 13) to turn off.

  pinMode(2, INPUT); // CI-V serial communication from IC7000
  pinMode(7, OUTPUT); // CI-V serial communication to IC7000
  pinMode(sMeterOut, OUTPUT); // set sMeterPin for output

  mySerial.begin(BAUD_RATE);
  mySerial.listen(); // only one port can be made to listen with software serial
  // see reference https://www.arduino.cc/en/Reference/SoftwareSerialListen
  while (mySerial.available()) mySerial.read(); // clean buffer
}

//-----
void loop()
{
  // read and display S-meter value

  mySerial.flush();

  // start sequence: send "read S meter" command to radio.
  mySerial.write(0xFE); mySerial.write(0xFE); mySerial.write(TRX_address); mySerial.write(0xE0);
  mySerial.write(0x15); mySerial.write(0x02); // Read s-meter , command 15 02
  mySerial.write(0xFD); // end sequence
  delay(20);

  // now read info from radio

  int nbChar = mySerial.available();

  if (nbChar > 0) {
    for (int readCounter = 0; readCounter < nbChar ; readCounter++) {
      byte byteRead = mySerial.read();

      if (readCounter == 6){
        sMeterVal1 = ( (byteRead/16*10) + (byteRead%16) ); // First byte: convert from BCD to
        decimal.
      }

      if (readCounter == 7){
        sMeterVal2 = ( (byteRead/16*10) + (byteRead%16) ); // Second byte: convert from BCD to
        decimal.

        analogWrite(sMeterOut, ((sMeterVal1 * 100) + sMeterVal2)); // Calculate and write the S-
        meter value on the S-meter output pin.
        delay(20);
      }
    }
  }
}
```

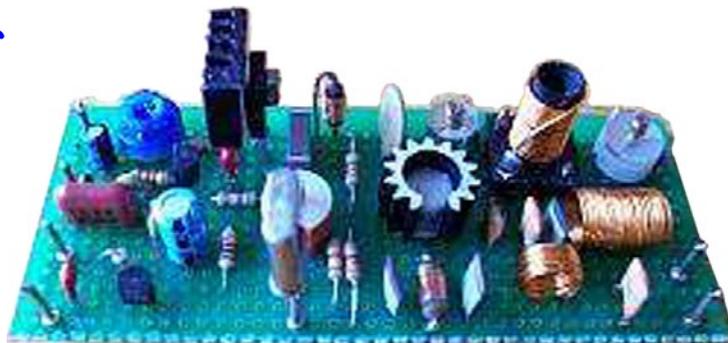
Published July 19, 2019 © GPL3+

<https://www.hackster.io/ddufault/external-s-meter-on-icom-radios-with-ci-v-port-d4e783>

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.

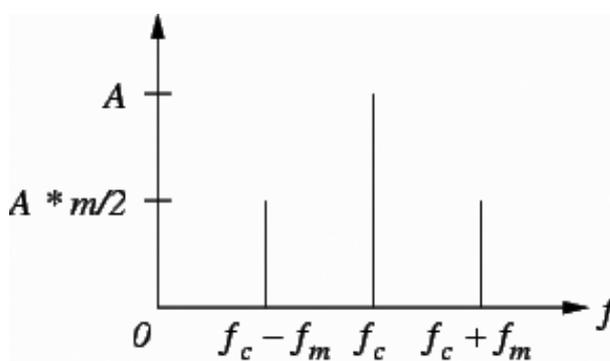
You'll see that you can receive the signal through the air with almost any AM radio receiver. Although the circuits used in radio stations for AM receiving are far more complicated, this nevertheless gives a basic idea of the concept behind a principle transmitter. Plus it is a lot of fun when you actually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

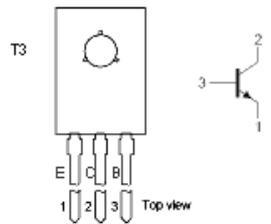
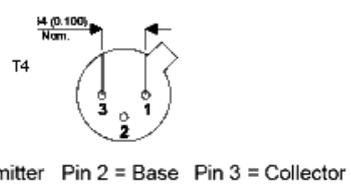
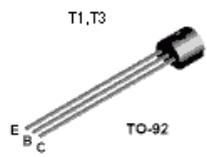
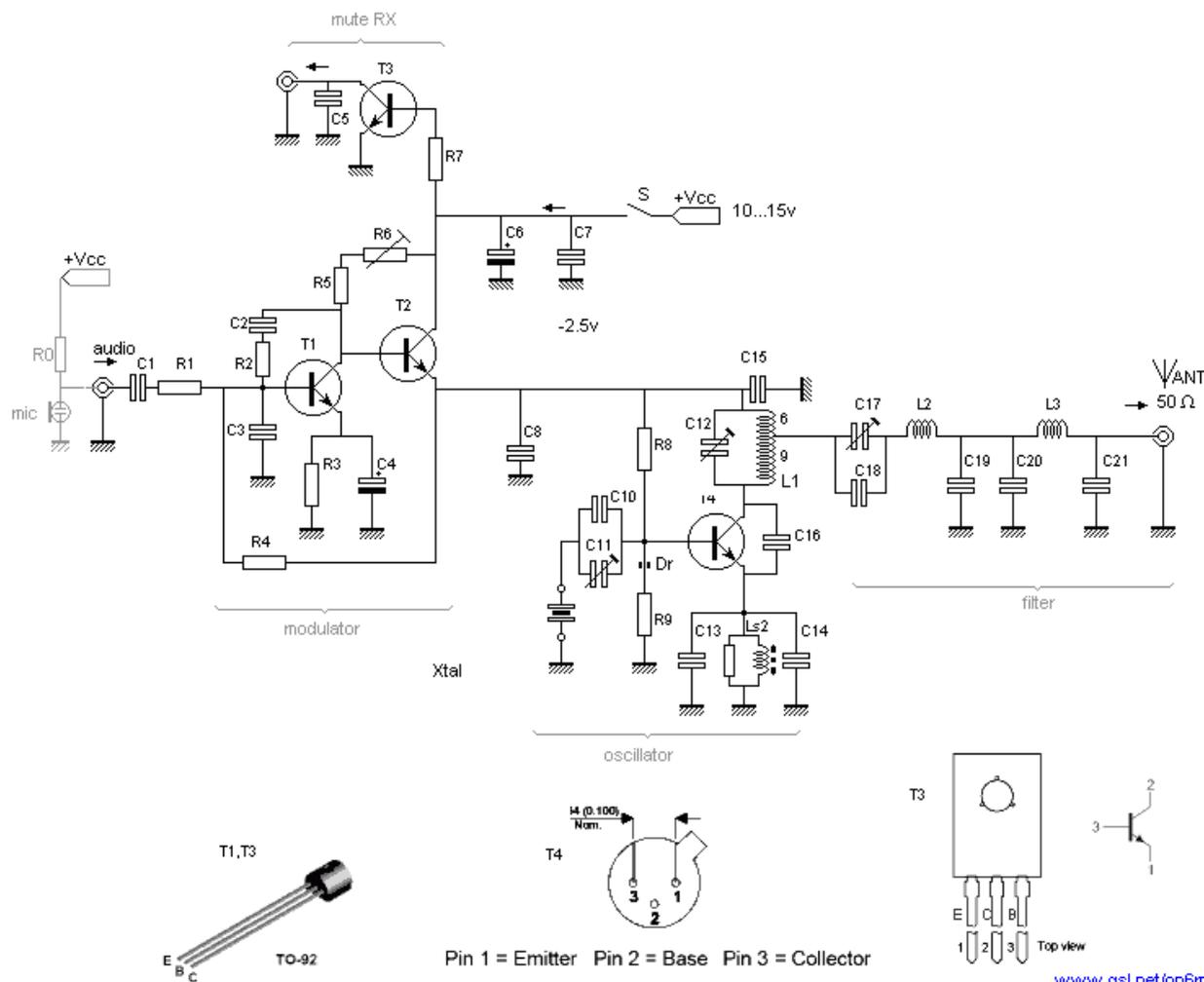
Housing/shielding

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



www.qsl.net/on6mu

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

Parts list 20-meter band transmitter

- | | | | |
|-----|----------------------------|---------|---|
| T1 | BC338, BC337 | C11 | 120pF (frequency offset +/- 2kc) |
| T2 | BD135 (with heatsink) | C12 | 0...18pF (peek at design frequency Xtal) |
| T3 | 2N2222, BC338 | C13,C14 | 330pF |
| T4 | 2N2219A (with heatsink) | C15 | 470pF |
| C1 | 220nF (polyester) rev1.2 | C16 | 47pF |
| C2 | 1500 pF (polyester) rev1.2 | C17 | 6...40pF (white) set at half position and tune to max power |
| C3 | 10nF (polyester) rev1.2 | C18 | 22pF |
| C4 | 47uF/25v | C19 | 180pF |
| C5 | 100nF | C20 | 220pF |
| C6 | 100uF/25v | C21 | 150pF |
| C7 | 100nF | R1 | 1k |
| C8 | 100nF | R2 | 3k3 |
| C10 | 12pF | 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



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 won't get any farther than the street you live in HI. Finally, atmospheric 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

Taken from users.belgacom.net/hamradio/schemas/transmitter_QRP_20meterband_on6mu.htm

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

This article previously appeared in H.A.R.S. Journal Issue No 16 • October 2018

Intermediate Licence Course : Project Work

Dave Porter G4OYX with Paul Austin M6NLT and Eric Edwards GW8LJJ

Not all HARS members may be aware that to progress through the training from Foundation licence to Intermediate requires that the candidate prior to the exam demonstrates not only their practical ability with simple circuits and measurements during the course but also submits a project that they themselves have built.

Many candidates opt for a Morse oscillator kit or maybe a simple audio amplifier for example, a Velleman kit using a TDA2004 and are able to demonstrate their soldering prowess as well as connecting it up on the course and checking it works.

Paul, M6NLT who passed the last FL course in Feb 18 let it be known that he had decided to build a superhet receiver. This was quite an advanced departure from the norm so when he passed on the details of the kit he was proposing to use, the curiosity necessitated a bit more research!

“You buy this - you have good time”

For what Paul had selected was a Chinese “hobby” kit: type number HX108-2. This is best described by the positively glowing eBay (Chinglish) citation which follows:

- Features: two in the standard circuit.
- In the middle of the week has been adjusted in the 465 KHz.
- Shell plastic as a new material, never to return.
- Circuit at all levels have Ic test port.
- Circuit diagram, assembly drawings, and other parts of the list, complete technical documents.
- Volume: 115 x 65 x 25
- Frequency range: 525-1605 KHz
- Output power: 100 MW [!]
- Power supply: 3V (No. 5 battery) (optional)

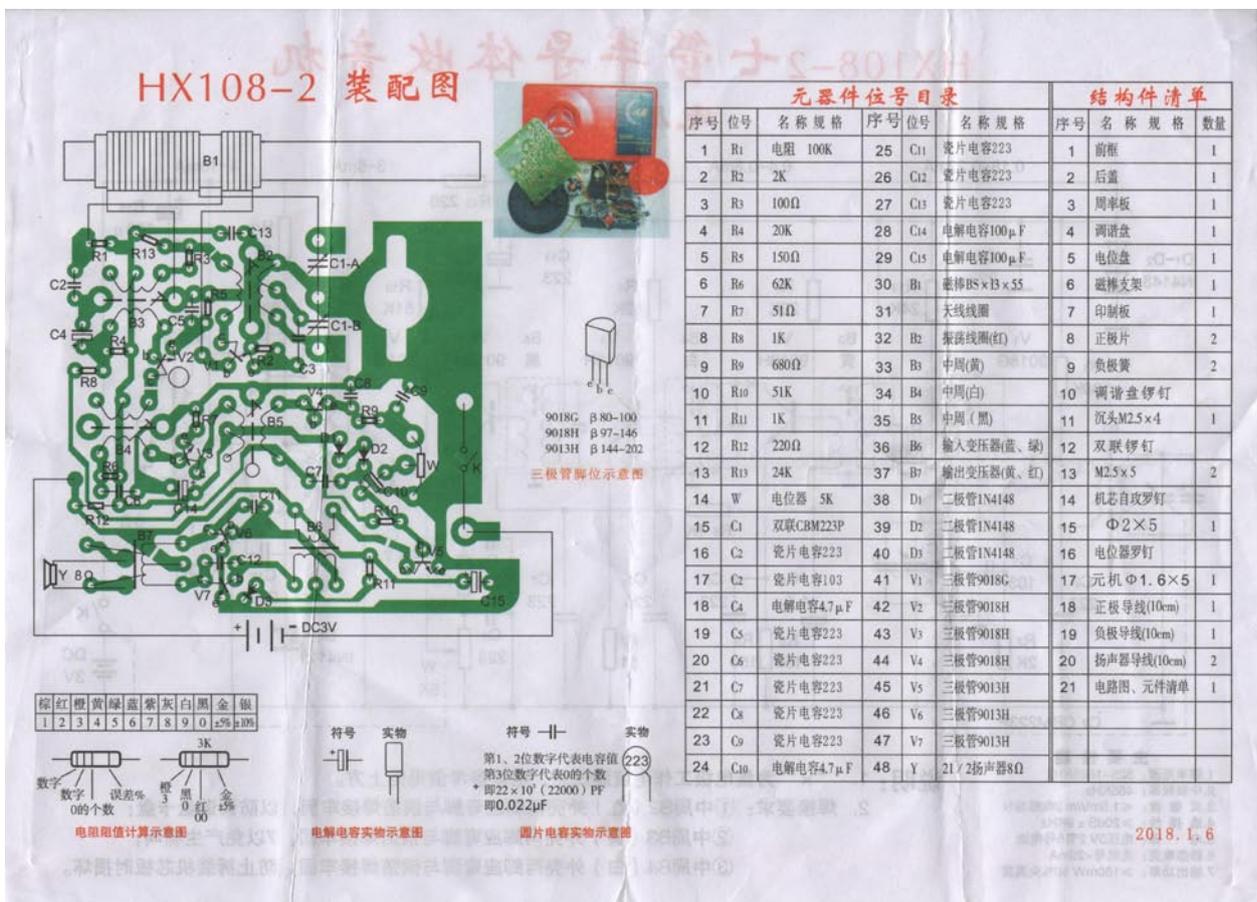


Fig. 1

- Circuit theory introduction: the main properties of the 108-2 7 transistor radio frequency range: 525~1605 KHZ; output power: 100 MW (max); speaker: 57 mm diameter, 8 ohm; power: 3V (No. 5 batteries second section); volume: 122 x 66 x 26. As shown in Figure 2.1 the electrical principle diagram. Seen from the figure, the whole machine contains 7 transistors, so called 7 tube radio. Among them, a triode V1 for converter tube, V2, V3 is in the discharge pipe, V4 detector tube, V5 for low frequency amplifying tube, V6, V7 for low frequency power amplifier tube.
- This kit does not contain a battery.

And again in English?

Er... yes! Best to say that it has seven transistors (rather than tubes!) It does cover medium wave only. The IF is 465 kHz rather than the usual Far Eastern 455 kHz. Two AA cells (copy to G4XTF!) are used in series giving a 3V rail. Two audio transformers are used for the push-pull output stage. Oddly the detector is the base and emitter junction of a regular silicon transistor. The maximum output

is 100 milliwatt rather than the 100 Megawatt in the document!

Intrigued - I also bought one for the princely sum of £3.91 **including postage** from suntekstore-uk. It is possible to buy multiples of these kits for substantially reduced prices.

Unbelievable value

Like Paul, I considered it unbelievable that it was so cheap; as many will recall six transistor portables coming into the UK from Hong-Kong in the 1960s and retailing at 59/6d. Even in the mid-70's silicon transistor versions were sold at £3.99 or so in Hurst St, Birmingham. Granted they were complete and working and not a kit but all the same; we would be hard-pressed now to buy just the components for the price of this Chinese kit.

Included in the bag of bits is a quarto-sized sheet of thin paper showing the circuit diagram and the component list with a pcb layout. These are reproduced as figures 1 and 2. Apologies for the scan quality but the paper is of the sort that years ago would have been used for air-mail letters and so is very thin and rather translucent!

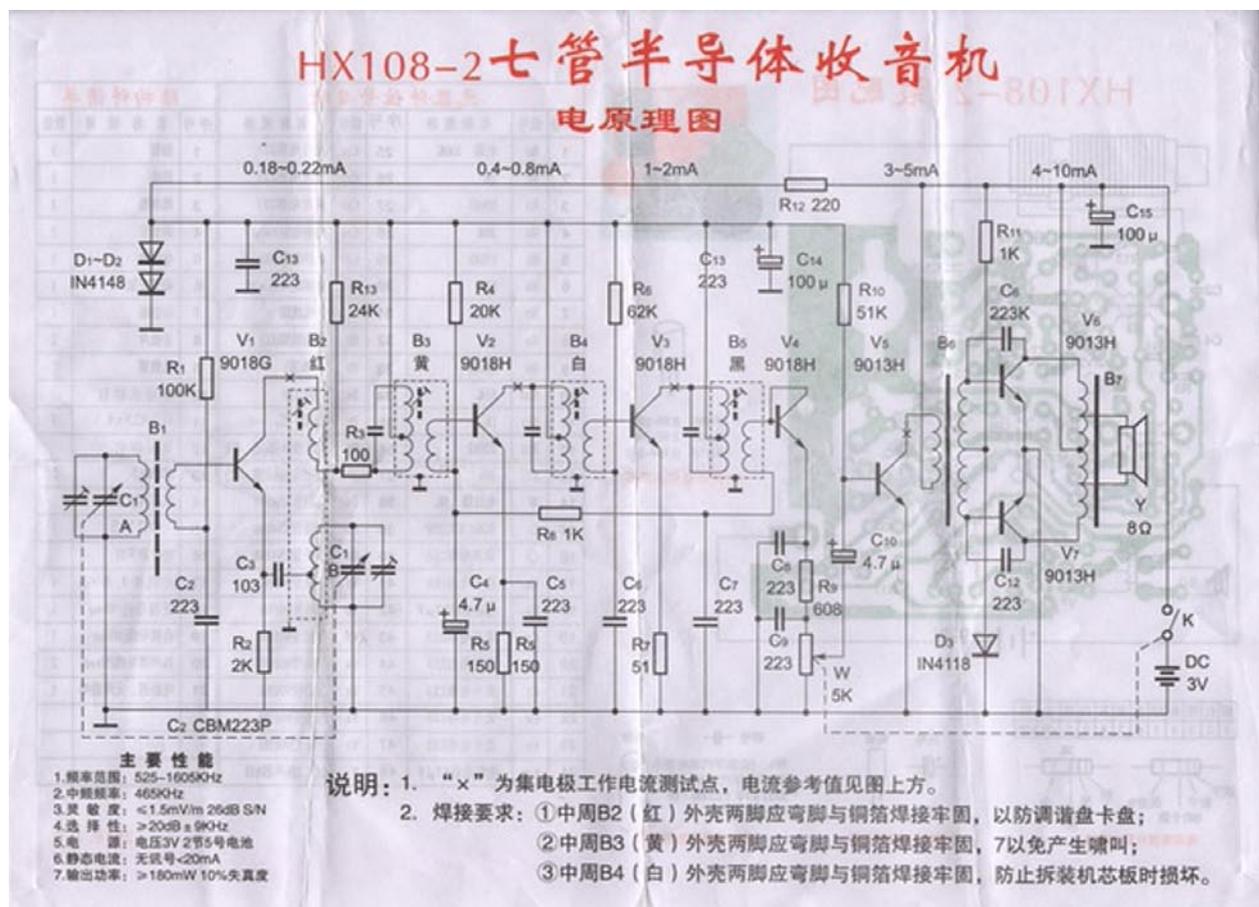


Fig. 2

All the hardware is included as well as a screen printed pcb showing the component placings. The document shows the resistor colour code and a generic worked example of 3000 Ω . There is a pin-out diagram of the transistors used including gain figures for the different suffixes possible, info on the + and – on vertical electrolytics and the marking 223 for the almost totally common, one-value 0.022 μF (22 nF, 22000 pF) ceramics employed because there is one sneaky 0.01 μF , 10 nF (103) ceramic in there as well.

Considering the rock-bottom price there is a fair sprinkling of premium $\pm 5\%$ E24 value carbon-film resistors including 62K, 51K, 24K, 20K, 2K and 51 Ω . For IL practice this is good as it requires advanced use of the resistor code over and above the regular, more well-known E12 values. Also, watch out for the jumbled number 1N4148 diode, which appears as 1N4118 in one situation!

Building the kit

It's best to arrange all the parts first in a line to see that all is present. If that's all OK then a foible of the kit's designer needs to be addressed and that is to check the circuit diagram for the X's in the printing. These represent points at which measurements can be made to check for correct operation usually by measurement of the current flowing. To permit this the pcb has gaps in the copper track that need closing with a bridge of solder whilst the pcb is clear of components. In the event of trouble-shooting being needed it would be easier to solder-wick a track open for a look if and when required.

Resistors, capacitors and transistors go in next followed by the volume control c/w on-off switch.

There may be trouble ahead

It is now that the in-built Chinese intelligence test happens. There are four canned RF transformers and two AF transformers. All the RF pinouts are the same and so are those for the AF pair. The component list specifies B2 – B5 for RF, the RF transformers themselves; are all colour-coded but which one is where, as the data is only in Chinese characters?

G4OYX asked Paul what to do about this and his detailed reply is here:



HX108-2 kit found on Ebay

As regards the different colour Oscillator and IF coils.....the Oscillator was really easy to spot - the only one with no capacitor in the base.

I measured the secondary inductance and resistance of each IF coil; this showed that yellow had the smallest number of secondary turns and black the most - by a significant margin. Obviously black must be the final IF (B5) as it needs a high turns ratio to ensure that the silicon detector is always forward biased even with weak signals. I suspected that yellow would be the first IF as lower turns means less loading on the mixer oscillator (and less risk of saturation at a point in the circuit where only one level of bandpass filtering has been carried out).

To be on the safe side I decided to opt for the old tried and tested mantra: If all else fails read the instructions (even if they are in Chinese!). On the bottom left of the parts list, it gives the resistor colour code in numbers 1 to 9 together with the corresponding Chinese character for each colour. I know the resistor colour code (therefore for the IF coils black = 0, yellow = 4, white = 9). This meant I could read off the Chinese character for each coil. Referring to the parts list I was then able to confirm that yellow is IF1 (B3), white is IF2 (B4), black is IF3 (B5).

That's the RF sorted; now what about the audio?

On both the circuit and on the pcb B6 is the driver transformer and B7 the output one. G4OYX reasoned that it was easy to spot the centre-tapped push-pull sides for base drives in on one and collectors out on the other. Measuring the other separate windings showed tens of ohms on one transformer and a low

value on the other so the lower one was out to the loudspeaker. Beware of the circuit diagram here as the output transformer is shown as a pseudo auto-transformer but it's not, there is a separate secondary! The tens-of-ohms single winding was the collector load for the driver transistor V5. Green is driver and yellow is output.

Final assembly

The variable capacitor is next and don't forget the L-shaped piece of plastic between it and the pcb. This holds the ferrite slab antenna in place once you have slid it in. Solder the four Litz wire spills to the track side of the pcb after checking out the correct orientation.

Solder up the positive and negative conns to the battery holders, on the circuit the on/off switch is shown in the positive... but it's really in the negative. With side-cutters remove the moulded plastic lugs on the case for the LSU as it just won't displace them enough to click-fit. Pop on some Bostik (other glues are available) to secure the LSU.

Now you need the tuning dial and fix to the capacitor but don't add the self-adhesive lined pointer sticker yet as it covers the screw fixing and you may need to remove that again to fault-find. The one on the volume control has no limitations. Next mount the pcb in the casing and solder the LSU and battery connections after fitting the sticker.

And switch on...

All was OK for G4OYX, the receiver worked and a few stations could be heard, but they were in the wrong places on the dial so alignment was required. Luckily Paul, M6NLT had described the process...

Prior to calibration, it is helpful to ensure that the coil on the ferrite slab antenna (B1) is offset towards the end as shown in the manufacturer's diagram next to the parts list. This is because B1 is also part of the RF tuned circuit, and the value will need to be adjusted during calibration. Maximum inductance occurs when the coil is in the centre, and minimum when at one end. The offset position (as shown) allows adjustment in both directions. On my particular radio, the optimum position after calibration turned out to be with the edge of the coil flush with the end of the ferrite slab.

As regards calibration, I used a modulated RF signal generator together with a DVM with analogue trend bar which I connected across the speaker.

For IFs, I set the receiver main tuning to around mid-band, (circa 1 MHz) making sure that there were no stations around there. I connected the sig gen to transistor 1 base (V1) via a 0.1 μ F capacitor. Keeping the sig gen output as low as practicable at all times to avoid AGC action, I set the sig gen to 465 kHz and adjusted B5, B4, B3 (in that order) for maximum output.

Looking at the dial calibration, the highest and lowest frequencies indicated are 1.6 MHz and 530 kHz respectively. 1.6 MHz is just far enough away from BBC Hereford and Worcester (Woofferton - 1.584 MHz) to get away with. At low frequencies, the lowest frequency readily detectable station during daylight hours is Wrexham, BBC Radio Wales on 657 kHz, so no problem with 530 kHz.

I connected the sig gen to a short coil (approximately ten turns wound on a Kitchen Roll cardboard inner) which I placed a couple of feet from the ferrite rod at right angles roughly in line with the centre of the ferrite slab. The rationale for the perpendicular positioning is to minimise direct coupling between the sig gen coil and B1. Similarly, for the central positioning it's to prevent the field strength from being larger on one side of the ferrite slab. Failure to do so would not affect steps 1 and 2 (below) but might affect the settings of the RF tuned circuit in steps 3 and 4.

- 1. Set the radio dial pointer to 530 kHz. Set the sig gen to 530 kHz and adjust the osc coil B2 for max output.*
- 2. Set the radio dial pointer to 1.6 MHz. Set the sig gen to 1.6 MHz and adjust the osc trimmer capacitor for max output.*

Repeat 1 and 2 until no further adjustments are needed.

- 3. Set the radio dial pointer to 530 kHz. Set the sig gen to 530 kHz and slide the coil B1 along the ferrite slab for maximum output.*

was mounted a LM1496 double-balanced modulator chip and peripheral components along with BNC sockets for the RF input and output and a phono socket for the modulation. 12 VDC was required at a few mA. Eric had used to data sheet to see how to unbalance the DBM to generate the AM, this being one of the options by the manufacturer. Eric has provided the full circuit and a pcb layout for this article.

In action, on test

Rather than connecting directly to the pcb as Paul did, an-air spaced coil of about 30 μ H was used to radiate the modulated 465 kHz after connecting up an AF tone source to the mod-input on the GW8LJJ pcb; the IFs tuned a treat. Then just as Paul did with the air-spaced coil the rest of the alignment was performed by selecting and switching between the 530 kHz and 1600 kHz memories in the DDS.

Eric's circuit and pcb layout is shown as Figure 3 and 4.

Conclusion

Well what a find of a project by Paul M6NLT, though by the time you read this he will undoubtedly have passed the Intermediate exam and may well be sporting a new 2E0 callsign!

Enjoy the ride back in time, you may even look out your Denco MTO1 or the classic Advance J1 valve alignment oscillator!

References

Dave GW4GTE has kits on <http://www.s9plus.com>

Also, look up HX108-2 on ebay.

Thanks, David ...Ed.

This article previously appeared in H.A.R.S. Journal Issue No 15 • August 2018

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) M00TG.

- 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.

The HARS Technical Library

This is the new lending library thanks to Bob G3IXZ, who is the "owner". The library is of course at Hill House - thanks to Geoff G8BPN. Great stuff here..., do take a look.



Subjects covered include: Antennas, Technical, Reference, Historical, Equipment and QRP.

This is really good Bob...thanks ...Ed.

Foundation Course Licence on-air experiences

Halisi Drysdale MW7ISI

To All those who passed the very successful class run by HARS, good evening!

I hope you can stomach my waffle - I've put off writing for a while despite wanting to update the group with the progress in my neck of the woods. I have to admit happily that any delay was a direct consequence of dabbling with the new world of amateur radio... seemingly I've stumbled on a classic classic phrase, "I'll just switch the transceiver on for 5 mins for a quick listen"... I now know that I've been trying to fool myself!

Firstly, yet again, a big thank you to the crew at HARS for the support and help in getting me up and running. We were all told through the weekend we shared that we can't wear out our call signs but I know the same is true of acknowledging the kind support of the team - I was able to borrow a handheld from, Josh's son, and then in turn I was "handheld" by Josh (M0WYP) with instructions through the first few overs after a quick trial of the equipment (a short bit on that in a moment). Needless to say, I was thoroughly excited to have made the short trip up the hill from my "QTH" to the Begwons and transmit via simplex and also through the GB3VM repeater. A great feeling; one that I hope you too have experienced already or will go on to do soon.

My eagerness to get on the air was fundamentally led by the fact that I had already left it 15 years to get the amateur licence and secondly, having received the paperwork, waited just a little too long to use it, meaning I could feel the confidence in operating a radio slipping away. It felt like two opposing magnetic poles when I tried to push the handheld's PTT after first picking it up... it took a day and a half of re-reading the notes we took and far more messages via What's App to Josh. I know the psychology can defeat us all when confidence starts to ebb gently away, so it meant I had to get back up on that bicycle we had all happily learnt to ride just those 2 short months ago!

Nostalgia and rose tinted memories of my first transmission a few weeks ago shall now be

placed to one side (before sickness ensues): the actual message is "get on the air people, the welcome is warm"... it really is worth the final push beyond the natural barrier to take that step into the new and unknown - if you have to push yourself (or even drag yourself) over the finish line, then do it as a final proof to yourself that you can. It's that same feeling just after passing a driving test; the feeling that in the first hour of driving after that formal exam has finished, where your confidence and ability gently grows beyond any of the many hours before, and then suddenly that realisation: it dawns that the size and reach of your world has expanded to a scale that was unimaginable just a moment before.

Further barriers:

I confess that I didn't just get up and get on air. Nope, that was a two or three day process which actually was governed more by an embarrassment (I hope that's the appropriate word) to say "love to give it go before I forget the theory... oh and I haven't got the spare dollars to get equipment just at this moment"... it may seem a rather poor excuse, indeed it sounds equally daunting an expression for me to type now, but given the (then) upcoming uncertainty of a certain topical world event currently keeping us from our ordinary activities, freely spending a limited financial resource on a new hobby was suddenly not a priority. I think it's a humbling moment when you ask simply for advice from people you've recently met, and instead of "here's a link to a cheap radio you can buy", comes an unexpected, "right, I've got a spare portable, one of the members may have an X-30 aerial you could possibly loan for a couple of months, do you need feeder or couplings? The club may have kit, speak to them too as it may help"... I was for a rare moment speechless, and that wasn't the end: I mentioned the "hand-holding" earlier, so it's worth reciting that process as it may reassure or inspire some of that much needed confidence briefly mentioned earlier.

Having made contact with Josh via What's App (a resource my family use at our home

because of poor mobile phone coverage), our communication continued through that mode. As it happened, with the handheld that I borrowed initially I was limited to the 5W Tx coupled with the smaller antenna. Because of this and intermittent phone signal, we naturally continued with the instructions, Q&A's and humour via real-time messages. This led concurrently into the first received overs and eventually my own signal reaching Josh "3-by-4". What we had done was real-time 'multi-mode' communication, where I was able to get full support throughout the process without the isolation or worry of making that [non-existent] "Big Mistake". It worked superbly and as far as I know was just the happy coincidence of the events.

What does that mean for you if you haven't dipped your toes into the ether of radio waves? There is very much a chance to get on air before all that learning we did in the test weekend fades, and equally there's the support and willingness to help all of us. Beyond that, once you're on the air more confidently (a quicker process than I could have imagined), the support from the contacts you'll make adds exponentially to the learning. It's been a wonderful few weeks. We are all moulded with somewhat clay feet, so my second, and continued humbling, experience is to have the reassurance from every QSO that they are all in exactly the same boat as we newcomers: we are all amateurs and enthusiasts; each of us always still learning and all of us with learning to share with others.

I really look forward to hearing you on the air very soon!

Hal (MW7ISI)

6 metres SpE from BBC Ariel Radio Group

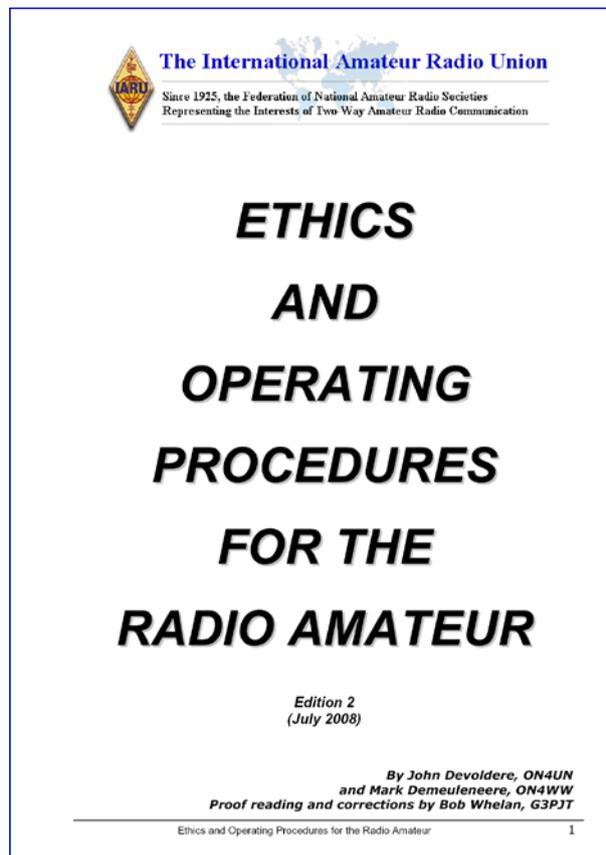
Nice little E's opening from 13:00 - 14:00 today (27 April 2020).

Southern UK to CT (IM57/58)

Worked 6 CT's.

At various points the CT's were working LA and OZ to the North and EA8 to the South.

I did hear AM4WARD but he was weak and on the edge of the opening.



PS. I came across a pdf which makes some effort to outline a common etiquette for on air transmissions. Its from <https://www.hamradio-operating-ethics.org/versions/> and the version I read was the "G - United Kingdom" one... treat it as is, and note that it's only something I found while googling a question or two I had on operating a radio for the first time. I'm sure/hope the experienced in this email thread will soon correct me on the relative merit of the document. Anyway, hope it is of some use or is interesting as a base point... but mainly, get on air :)

At the very end of the opening G stations in IO92 seemed to be hearing the EA8's but couldn't work them.

Signal levels were typical for E's with CT1ILT peaking at +16 which is seriously loud !

All QSO's were in FT8

73 Chris G6XDI

Listening on 160 metres

There are several ways to start tuning in to 160 metres.

You can either modify an old AM transistor radio, buy a special 'communications receiver' or make your own. Modifying an old radio is easiest and cheapest, so we'll start with this first.

Getting started: obtaining an AM radio

Almost any portable AM broadcast radio can be made to receive 160 metres. Find a battery powered one with an old-fashioned tuning knob and dial; digital tuning radios are no good. If you don't have one, try garage sales and swapmeets. Radios made in the 1960s, 70s and early 80s are best. Medium-sized portables go better than pocket or clock radios. FM is not needed. Pay no more than \$10.

The hard bit: doing the conversion

1. Find out when 160 metres is most active in your area. WIA broadcast relays or other long transmissions are best. In Melbourne the 11am Monday - Saturday 'Coffee Break' net is suggested.
2. Disconnect any mains power leads.
3. Remove back with screwdriver and insert batteries.
4. Find a weak AM station near 1600 on the dial.
5. Identify tuning capacitor. This is the plastic box on circuit board approx 25mm square. Note the small screwdriver slots that you will be adjusting.
6. With set operating adjust the tuning dial to read slightly lower so station sounds distorted.
7. With a small flat-blade screwdriver adjust one of the screwdriver slots. If nothing happens you've found slots for FM or shortwave "leave these alone. If the station gets weaker, but stays distorted you've located the 'front-end' tuning "take note but leave alone for now. If the station gets clearer, but a slight adjustment the other way makes it vanish, you've found the 'local oscillator' adjustment,
8. Repeat until your chosen 1600 kHz station appears near 1450 on the dial.
9. Move dial to near 1600.
10. With screwdriver adjust 'front-end' tuning setting for maximum noise out of radio. You will notice that adjusting moves some tiny metal plates on this component, which is called a trimmer capacitor. When you see a semi-circle all plates are overlapping and the capacitor is at its maximum setting. When plates are not overlapping, you will see a full circle and the capacitor is at minimum capacitance.
11. Tune around for amateurs. Amateurs will be using frequencies up to about 1850kHz, but because we have adjusted the insides of the radio, they will appear near 1600 on the dial.
12. Re-peak 'front-end' tuning for maximum strength on these signals. Because higher frequencies require less capacitance, the trimmer capacitor's plates will hardly be



Picture of AM radio modified to 160 metres

which is what we need. Again set the radio dial lower and re-adjust the local oscillator to bring the station back again.

overlapping. If there is no overlap at all (ie full circle) the radio may not be adjusted for peak sensitivity. Refer to the optional step 13 for a way to get around this.

13. (optional) If receiver sensitivity is still poor, and you can't hear noise out of the radio even when the volume is turned up, you might have to work on the coil of wire on the ferrite rod. The ferrite rod is the long black thing that's between about 50 and 150mm long, located near the tuning capacitor. The coil is usually wound on a light cardboard sleeve wrapped around the rod. Without disturbing the windings, slide this coil towards one end of the rod. If the sleeve does not move along the rod, gently dislodge the wax that's holding it tight. You should hear an increase in signal strength, or if there is no activity on the band, noise level. Secure the sleeve with either wax, tape or a small dab of glue.

14. Replace back and rotate set for best signal.

All this should only take 15 minutes and requires no soldering or knowledge of electronics. The video demonstration below may help if you get stuck.



<https://youtu.be/-TssuQZuMNM>

Receiving SSB on an AM receiver

If you need to resolve SSB 'duck talk' signals you will need a beat frequency oscillator, which produces a small local signal on either the main receiver's intermediate frequency or the actual frequency of reception. Either build one or use another old AM radio. For the latter, position it near the main receiver and tune 1350 - 1400 kHz on the dial. This will place its local oscillator just above 1800 kHz. If you hear 'duck talk' tune the second receiver until

the sound from the modified receiver changes. If the tuning is adjusted very carefully you will be able to understand the transmission. Morse is similar except the tuning is less critical. Move the BFO receiver closer or further away from the main receiver for best results with varying signals. A video demonstration of the concept is below.



<https://youtu.be/0F5CxME9EYw>

Buying a radio for 160 metres

Many of the better sets that cover 'shortwave' also cover 160 metres. Look for a radio that offers 'continuous coverage' over the 0.53 to 30 megahertz range. If it has a 'BFO' or beat frequency oscillator, so much the better as you will be able to hear single sideband (voice) and CW (morse) signals.

Some newer sets offer digital readouts, but may still miss 160 metres. Some older sets with dial tuning may have a shortwave range that covers 1.6 to 4.0 megahertz. This will allow reception of 160 (and 80) metres without modification, but will need a BFO for SSB.

Building a radio for 160 metres

If you are within 3km of a 160 metre AM operator, and have a good antenna, signals can be heard on a batteryless crystal set receiver. However amateurs use lower power than most broadcasters, so a better receiver is almost essential.

A type of radio called a regenerative receiver is excellent for the job and quite simple to build. You could even make it cover both the AM broadcast band and 160 metres and be able to receive signals from interstate if conditions are favourable. [Here's an example](http://home.alphalink.com.au/~parkerp/gateway/nonov99.htm) (<http://home.alphalink.com.au/~parkerp/gateway/nonov99.htm>).

Add an up-converter to a 27 MHz CB radio

Just a few parts will allow 160 metre reception. Demonstration and circuit is below:



<https://youtu.be/mgcUAVQodaw>

160 metre propagation: How far can I hear?

During the day 160 metres provides good local coverage out to about 50 km. At night distances possible increase, with interstate contacts being possible. If conditions are really good, or if you have a good receiver, proper antenna and location without much interference, you will hear North Americans and New Zealanders at night and Europeans in the early morning. Around sunrise and sunset are the best times for really long distance reception. Note though that all long-distance activity is SSB and CW, and AM is more suited to local communication.

Improving 160m reception

If you are within 10 or 20 km of most stations, you probably won't need an external antenna. However a wire or loop will help on weaker signals.

A good project ...Ed

<http://home.alphalink.com.au/~parkerp/gateway/160listen.htm>

Software Defined Radio

<http://www.arrl.org/software-defined-radio>

Introduction

Software Defined Radio attempts to place much or most of the complex signal handling involved in communications receivers and transmitters into the digital (DSP) style. In its purest form, an SDR receiver might consist simply of an analog-to-digital convert chip connected to an antenna. All the filtering and signal detection can take place in the digital domain, perhaps in an ordinary personal computer. While there are still good reasons to use some analog components in high-performance gear, the SDR approach is becoming more common in Amateur Radio.

Articles

- **The DSP-10: An All-Mode 2-Meter Transceiver Using a DSP IF and PC-Controlled Front Panel** by Bob Larkin, W7PUA

What's neat about this 2-meter transceiver is that most of it is in software! Your PC is its front panel.

[Part 1](#) QST September 1999, pp. 33-41

[Part 2](#) QST October 1999, pp. 34-40

[Part 3](#) QST November 1999, pp. 42-45

Note: [additional Web link](#)

- [A High-Performance, Single-Signal, Direct-Conversion Receiver with DSP Filtering](#) (283,604 bytes, PDF file)

QST April 1998, pp. 40-43

Articles referenced in the above article

- [A High-Performance, Single-Signal, Direct-Conversion Receiver](#)

QST January 1993, pp. 32-40

- [High-Performance Direct-Conversion Receivers](#)

QST August 1992, pp.19-28

- **Signals, Samples and Stuff: A DSP Tutorial** by Doug Smith, KF6DX/7

[Part 1](#) QEX, March 1998, pp. 3-16

[Part 2](#) QEX, May 1998, pp. 22-37

[Part 3](#) QEX, July 1998, pp. 13-27

[Part 4](#) QEX, September 1998, pp. 19-29

- [**A DSP-Based Audio Signal Processor**](#)

QEX September 1996, pp. 8-13

- [**Linux, Software Radio and the Radio Amateur**](#)

QST October 2002, pp. 33-35

How software radio technology might revitalize experimentation in Amateur Radio

- [**A Software-Defined Radio for the Masses**](#) by Gerald Youngblood, AC5OG

This series describes a complete PC-based, software-defined radio that uses a sound card and an innovative detector circuit.

[Part 1](#) QEX Jul/Aug 2002, pp. 13-21

[Part 2](#) QEX Sep/Oct 2002, pp. 10-18

[Part 3](#) QEX, Nov/Dec 2002, pp. 27-36

[Part 4](#) QEX, Mar/Apr 2003, pp. 20-31

- [**The Need for Standard Application-Programming Interfaces \(APIs\) in Amateur Radio**](#)

QEX Jan/Feb 1999, pp. 19-21. *Members Only*

- [**Software-Defined Hardware for Software-Defined Radios**](#)

QEX Sep/Oct 2002, pp. 41-50

Using programmable logic in Amateur Radio applications

- [**A High-Performance Digital Transceiver Design**](#) by James Scarlett, KD7O

Data-converter technology has made tremendous strides in the past several years. Lets take a look at how we can achieve high performance in an almost-all-digital radio design.

[Part 1](#)

[Part 2](#)

[Part 3](#)

- [**Linrad: New Possibilities for the Communications Experimenter**](#) by Leif Åsbrink, SM5BSZ

Discussion opens with analog versus digital RF-input techniques and attendant performance considerations.

[Part 1](#)

[Part 2](#)

[Part 3](#)

[Part 4](#)

[Part 5](#)

- [**An All-Digital SSB Exciter for HF**](#)

appeared in the May 2008 issue of QEX, pages 3-10. James Ahlstrom N2ADR's transmitter uses an FPGA and software.

- [**All-Mode 1 kHz to 1.7 GHz SDR Receiver**](#)

January 2016 QST pp 30-33, Feedback March 2016 QST p.46

Web Links

[High Performance Software Defined Radio--An Open Source Design](#)

A High Performance SDR (HPSDR) - an open source (GNU type) hardware and software project intended as a "next generation" Software Defined Radio.

[Advanced Technology in Amateur Radio](#)

[video](#) - Talk given by Doug Smith, KF6DX, QEX Editor at Georgia Tech, March 10, 2003. Windows WMV format, 110 minutes.

[FCC News:](#)

FCC adopts rule changes to facilitate deployment of Software Defined Radio technology.

[Introduction to DSP](#)

The BORES Signal Processing DSP course - Introduction to DSP - is free of charge on line.

[f4dan.free.fr](#)

Christophe Bourguignat, F4DAN, maintains categorized and annotated links to different software defined radio technologies.

Thanks, Christopher ...Ed.

Ofcom engineers shine a light on interference issue

23 March 2020

Ofcom's spectrum assurance team recently solved a sky-high interference case that took more than a little detective work to crack.

The team were contacted by National Air Traffic Services to let them know that aircrafts flying in and out of Glasgow airport were being affected by interference when they were between 6,000 and 10,000 feet in the air.

The interference was affecting voice communications between the controllers on the ground and the aircraft. Whenever the aircraft were in the vicinity of the interference the crew would not hear any air traffic control messages as the signal was swamped by the noise of the interference.

Needle in a haystack

But what was causing the problem – and crucially, where was it? The next step was for the team to locate and identify the source of the interference.

However, due to the height of the aircraft (not to mention the speed of their flight!), the team described how identifying a potential cause would be like looking for a needle in a haystack.

Our spectrum engineering officers spoke to the National Air Traffic Services (NATS) in order to narrow down the search area.

They were able to create an 'area of probability' on a map, in which they could focus the search for the source. This was done by using flight-tracking software, which allowed them to make a note of where the aircraft were when they reported the issue – and this in turn helped to identify a corresponding location on the ground.

Following this discovery, the search turned into a ground-level investigation centred on a small town.

This monitoring involved using vehicle mounted receivers and driving the suspected area until the interference was heard. Once the team have located a location where the signal



Plot of Carluke source.

is strongest they then use hand held equipment to cover the remainder of the search area on foot. The team visited a number of properties that were adjacent to the property where they eventually located the source. After a search phase, the source of the interference was found to be a home. Specifically, the cause was four 'vintage' lightbulbs that the homeowner had recently bought online.

What's that noise?

Due to the construction of the bulbs, they were found to be radiating a 'noise' when they were switched on that affected a wide range of spectrum, rather than just one frequency. The house was directly underneath the flightpath of the aircraft and therefore every time an aircraft passed and the bulbs were in use, the crew suffered the interference.

Unfortunately for the owner – but fortunately for the crew and passengers of flights in and out of Glasgow airport – the bulbs were removed from the sockets and checks with NATS and aircraft operators confirm that the area is now free of interference.

Now our spectrum enforcement team will follow up the case with the lightbulb suppliers,



Carluxe source light bulb.

to make sure the bulbs aren't sold to any more unwitting customers.

What is spectrum?

You can't see or feel radio spectrum. But any device that communicates wirelessly needs spectrum – such as televisions, car key fobs, baby monitors, wireless microphones and satellites. Mobile phones use spectrum to connect to a local mast so people can make calls and access the internet.

Why does Ofcom manage spectrum use?

Only a limited amount of spectrum is available, so it needs to be managed carefully. Certain bands of spectrum are also used for different purposes. For example, mobile companies use different parts of the spectrum to TV companies. So, it needs to be managed to prevent services interfering and causing disruption to people and businesses.

Enlightened ...Ed.

https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/interference-issue/_nocache?utm_source=facebook&fbclid=IwAR3d6f6u2JfSLbHQwNITY7r3Z8kWd_yDyUsB0hFDVd46PW15qjZ8WlOPOf0

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)*

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£114.95
Excl. Tax: **£95.79**



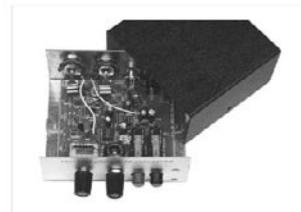
MFJ-9380K
£106.96
Excl. Tax: **£89.13**



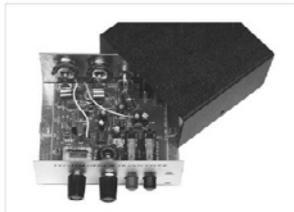
VEC-104K
£99.95
Excl. Tax: **£83.29**
Regular Price: **£109.95**



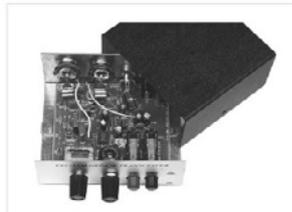
Vectronics VEC-102K IT, SHORTWAVE RECEIVER KIT
£99.95
Excl. Tax: **£83.29**



Vectronics VEC-1380K KIT, 80 METER QRP TRANSCEIVER
£74.95
Excl. Tax: **£62.46**



Vectronics VEC-1340K KIT, 40 METER QRP TRANSCEIVER
£74.95
Excl. Tax: **£62.46**



Vectronics VEC-1330K KIT, 30 METER QRP TRANSCEIVER
£74.95
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Vectronics VEC-1402DK
£69.95
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Ramsey AA-7C HF/VHF Active Antenna Kit
£69.95
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Ramsey LB-56C Infrared Light Beam Communicator Kit
£59.95
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Ramsey FR-10C 10 Meter VHF FM Receiver Kit W/case
£59.95
Excl. Tax: **£49.96**

I have checked and the Portsmouth Waters and Stanton store is open and they are taking orders and are doing deliveries.

...Ed.



Ramsey FR-1C FM broadcast Receiver Kit

£59.95

Excl. Tax: £49.96



Ramsey FR-146C 2m VHF FM Receiver Kit

£59.95

Excl. Tax: £49.96



Rasmey ECG-1C Electrocardiograph Kit

£54.95

Excl. Tax: £45.79



Vectronics VEC-1680KC KIT CASE, VACUUM TUBE AMPLIFIER

£49.95

Excl. Tax: £41.62



Ramsey TV-6C Television Transmitter Kit

£47.95

Excl. Tax: £39.96



Vectronics VEC-1010K

£40.95

Excl. Tax: £34.12



Vectronics VEC-1006K

£40.95

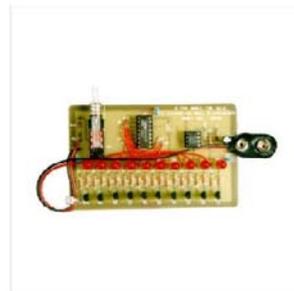
Excl. Tax: £34.12



Vectronics VEC-221K KIT, CW MEMORY KEYS

£39.95

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Vectronics VEC-1500K KIT, SOLDERING

£35.95

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Vectronics VEC-131K KIT, AIRCRAFT RECEIVER

£35.95

Excl. Tax: £29.96



Vectronics VEC-1290K KIT, AM RADIO TRANSMITTER

£35.95

Excl. Tax: £29.96



Vectronics VEC-1280K KIT, 80M TRANSMITTER

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Vectronics VEC-1230K KIT, 30M TRANSMITTER

£35.95

Excl. Tax: £29.96



Vectronics VEC-1220K KIT, 20M TRANSMITTER

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Excl. Tax: £29.96



Vectronics VEC-1180K KIT, 80M RECEIVER

£35.95

Excl. Tax: £29.96



Vectronics VEC-1130K KIT, 30M RECEIVER

£35.95

Excl. Tax: **£29.96**



Vectronics 1240K CW Transmitter Kit

£35.95

Excl. Tax: **£29.96**



Vectronics VEC-101K KIT, SHORTWAVE CONVERTER

£33.95

Excl. Tax: **£28.29**



Vectronics VEC-121K KIT, CRYSTAL RADIO SET

£29.95

Excl. Tax: **£24.96**



Ramsey RFS-1 Radio frequency switch

£26.95

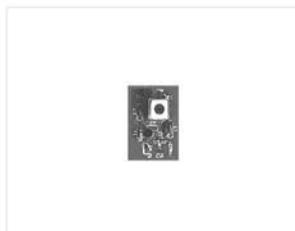
Excl. Tax: **£22.46**



Vectronics VEC-483K KIT, VOICE ACTIVATED TAPE RECORDER CONTROL

£24.95

Excl. Tax: **£20.79**



Vectronics VEC-1402K KIT, 2M PRE AMPLIFIER

£22.95

Excl. Tax: **£19.12**



Vectronics VEC-1202KC

£19.95

Excl. Tax: **£16.62**



Vectronics VEC-821KC

£19.95

Excl. Tax: **£16.62**



Vectronics VEC-483K KIT CASE, VOICE ACTIVATED TAPE RECORDER CONTROL

£19.95

Excl. Tax: **£16.62**



Vectronics VEC-422KC KIT CASE, SCA DECODER

£19.95

Excl. Tax: **£16.62**



Vectronics VEC-412KC KIT CASE, NICAD BATTERY CHARGER

£19.95

Excl. Tax: **£16.62**



Vectronics VEC-221KC KIT CASE, CW MEMORY KEYS

£19.95

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Vectronics VEC-131KC KIT CASE, AIRCRAFT RECEIVER

£19.95

Excl. Tax: **£16.62**



Vectronics VEC-1300KC KIT CASE, 20/30/40/80M TRANSCEIVER, 1320/30/10/80

£19.95

Excl. Tax: **£16.62**



Vectronics VEC-1200KC KIT CASE, 20/30/40/80 TRANSMITTER, 1220/30/40/80

£19.95
Excl. Tax: £16.62



Vectronics VEC-1100KC KIT CASE, 20/30/40/80M RECEIVER, 1120/30/40/80

£19.95
Excl. Tax: £16.62



Vectronics VEC-201KC KIT CASE, CW KEYS

£19.95
Excl. Tax: £16.62



Ramsey TS-1 Touch Switch Kit

£15.95
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Vectronics VEC-1290KC KIT CASE, AM RADIO TRANSMITTER

£14.95
Excl. Tax: £12.46

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