

## The Hayling project

### **Introduction**

The introduction of advanced SDR hardware such as LimeSDR and Adalm pluto means it is now possible to receive and generate signals on the lower and medium microwave bands from a single “box solution” at very low cost. This, coupled with the development of high powered single board computers such as the Rpi, means it should now be possible to build an advanced multi-band multi-mode radio using off the shelf components for under £250.

However, whilst the various modules to do this are available as standalone items, there does not seem to be a single integrated offering which makes it easy for users to get on the air.

### **The proposal**

This proposal is for a UK microwave group sponsored project to develop a VHF/UHF and microwave transceiver developed around the Raspberry PI and commonly available SDR hardware such as LimeSDR Mini or Adalm Pluto. It would provide a basic transceiver primarily designed to give coverage of the 1.2, 2.3, 2.32, 3.4 and 5.6 GHz microwave bands.

The idea is to develop a receive/transmit system along the lines of the BATC Portsdown system, which uses a number of software modules developed by various people within the ATV community, to provide a standalone, easy to use DATV transmit system. Over 350 people have purchased components to build the Portsdown and it has enabled significant numbers of stations, including several members of the Microwave group committee, to overcome the significant challenges to get on the air with DATV.

Hayling is suggested as the project name in memory of Mike Walters, G3JVL, who lived on Hayling Island and as well as the development of efficient microwave antennas and the JVL waveguide based transceiver provided help and encouragement to many of today's microwavers to get on air.

### **Project aims and scope**

The project aim is to produce a standalone transceiver with operation from 50 MHz up to 5.7GHz depending on the hardware used. The aim would be to provide a totally self-contained dedicated transceiver, ideal for use out portable.

It is envisaged the major focus and work for the project will be the integration of a number of existing software modules and to provide an easy to use user interface.

The project would not be set up to directly provide an SDR education course but should be seen as a community develop project with files hosted on Github or similar and people will be encouraged to contribute and learn by doing so.

### **Outline specification**

The key to the success of a project like this is to agree a very tight spec before development starts and aim to have phased releases for new functionality. Without this level of control, the volunteers

doing the work will soon feel overwhelmed by feature demands and complaints from the user community – under promise and over deliver is the key to success!

It is envisaged that the project will be developed on the Rpi4 and an integrated touchscreen. The Element 14 7" screen used on the Portsdown has proved to be very reliable and useable in portable environments. Note there are significant differences with between the Rpi 4 and earlier hardware versions and it is suggested that no backwards compatibility would be offered.

SDR hardware compatibility should be targeted at the LimeSDR mini and Adalm Pluto which are available for under £200 and will give coverage of all bands up to 3.4 GHz (5.6GHz in the case of the Pluto).

An external USB dongle would be used for audio in and outputs.

Exact hardware and case design should be left to the individual constructor.

The basic functionality would be CW, USB and FM modes on both transmit and receive. The aim would not be to produce a complex unit which competes for the number of bells and whistles with a state of the art commercial transceiver but provides a good basic low power transceiver which enables contacts on the microwave bands. The unit will also provide coverage of 50MHz and 144Mhz but RF performance may not be comparable with transceivers designed for those bands.

Additional functionality which may be incorporated at later phases could include:

- SDR waterfall display
- Integration of CW keyers and readers
- Integration of WSJT and similar modes
- KST and Zello screens
- Web interface and remote control

### **Companion products**

The SDR transceiver will provide basic functionality and can be used as the basis for several DIY construction projects to provide the required filtering, power amplifiers and pre-amps .

This is an ideal opportunity for the microwave community to encourage home construction and use Scatterpoint to publish or re-publish a series of designs under the Hayling project name.

Designs for more advanced compatible low cost transverter solutions for the higher bands could also be published as part of the Hayling project.

### **The Portsdown project**

This proposal is written based on the very positive impact the Portsdown project has had for the ATV community. Given the support of the Microwave group I see no reason why this success could not be replicated for Narrow Band microwaves.

The BATC is happy for the Hayling project to use any code the team thinks appropriate and it is all in the public domain on Github. Note some of the UI code may no longer be directly re-useable due to some libraries becoming obsolete with the release of the RPi4.

There are also some Portsdown PCBs which may be of use for the Hayling project such as Rpi GPIO breakout, 4 and 8 way RF switches and PTT steering boards – these could be made available to non BATC members through the UK Microwave group.

The BATC team are also happy to share their experiences in running such a project.

### **What resources do we need?**

To make this happen, the key thing is to build a small core team who will promote and develop the project and find at least one person who has the capability to understand and integrate the various modules required. They will also need to understand basic UI design and be willing to provide ongoing support to the community of constructors.

A large number of software modules are already available although some run under the desktop and others natively – these are a few I found from a quick web search:

- F5OEO has developed basic SSB and FM transmit functions – already used by stations on Oscar100 and available on Github
- GQrx is an SDR rx package <http://gqrx.dk/download/gqrx-sdr-for-the-raspberry-pi>
- WSPR <https://gerolfziegenhain.wordpress.com/2013/04/13/raspi-as-wspr-transmitter/>
- WSJT package for Rpi

### **The community and online support**

The project will need some dedicated on line support and it is suggested the Microwave Wiki would be used to set up the user manual and reference pages.

This would not be used for Q+A which will require a community forum - email reflector is not appropriate for this as people need to be able to read back across the history of a thread in one place. The community forum would also be the place to exchange ideas on hardware design including cases and add on functionality.

A UKmicrowave group github should be used for version control and distribution of the files.

These resources will be significant in help build the self-help community required for the success of such a project.

### **Conclusion**

Whilst this is a challenging project which will need to be undertaken by the right team, it is a great opportunity to build a product that is the easy way to get on to microwaves.

It will be a great story for the UKMicrowave group to demo and talk about at rallies etc. and is great way to interest new comers to microwavers and build a strong community around the project. The project will also provide a large number of articles for publication in Scatterpoint and content for articles in the GHz column and standalone articles in Radcom.