

Radio Frequency Interference Survey

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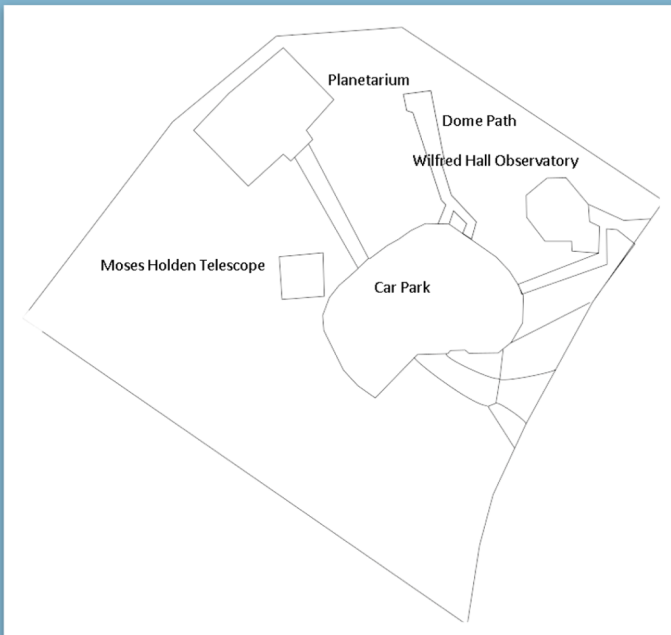
Alston Observatory, owned by the University of Central Lancashire, and operated by the Jeremiah Horrocks Institute, is an excellent place for students to learn about the operation of telescopes via the optical Moses Holden Telescope.

However, there is an opportunity for a small radio telescope to be built, allowing for a wider range of projects to be done at the site, however the site's radio environment must be surveyed to see if it is suitable. The Telescope would observe at 1420 MHz, or the hydrogen line, and be able to take measurements of the neutral hydrogen in the Milky Way and Andromeda Galaxy, and be an ideal introduction for students into radio astronomy.



A small telescope like the ones in the SALSA array in Sweden (Left) is the sort of telescope that is planned for the site

The Planetarium at Alston Observatory (Below)



The site consists of 4 main parts:

The Moses Holden Telescope, a CKD 700 optical telescope

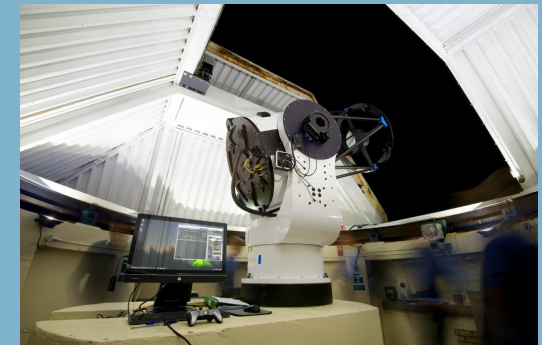
The Wilfred Hall Observatory, housing the Wilfred Hall Telescope as an exhibition space

The Planetarium, used for outreach programs

The dome path, which has two small telescope domes along it for free standing telescopes



The Wilfred Hall Observatory Exhibit (Left)



The Moses Holden Telescope dome (Right)

Survey Setup

The setup will consist of two pieces of equipment and a piece of software:

The receiver is an SDRplay RSPdx, which can process the spectrum from 1 kHz to 2 GHz, which covers at and around the 1420 MHz needed, allowing for a wide spectrum survey to be done if needed.

The Antenna is an OmniLOG 90200 Antenna, which is an omnidirectional antenna that covers the spectrum from 700 MHz to 2.5 GHz, which also covers the range needed.

The software that will be used is the RSP Spectrum Analyser software, which is a third party application built for the RSP family of receivers. It allows for observations of the spectrum at different bandwidths, and has a variety of features that may be useful for a site survey.

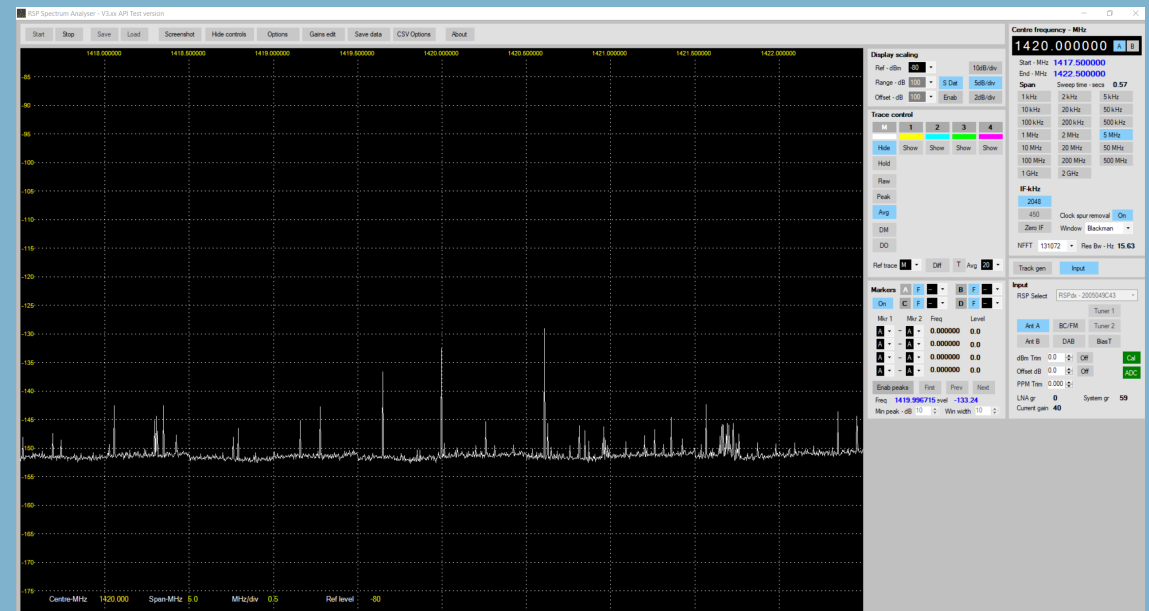


The setup for how the components will be used on the site

An overview of the RSP Spectrum analyser

The OmniLOG 90200 Antenna and the SDRplay RSPdx

(www.aaronia-shop.com/products/broadband-antenna-omnilog-90200)



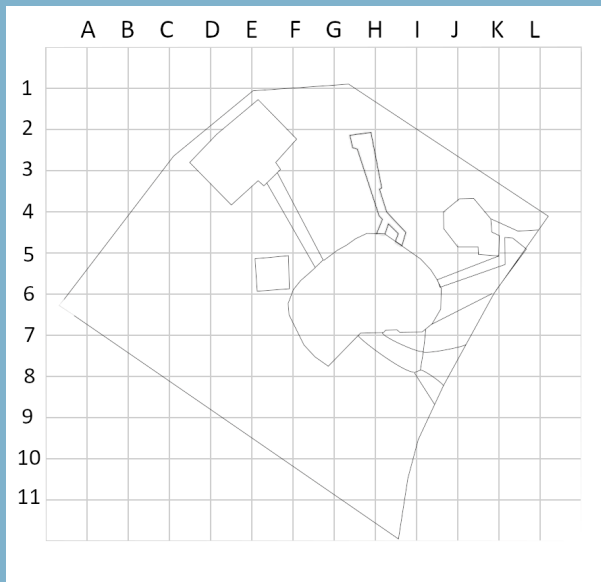
Method

Due to the multiple buildings on the site that could have sources of interference, a grid survey will be done over the site, to help identify whether a signal is consistent over the site, and from an external source like a radio tower or from a specific building.

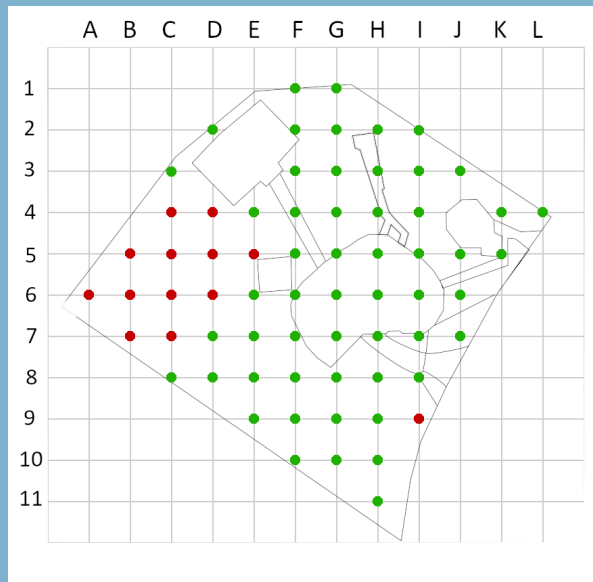
An initial survey was done to see which points on the grid can be surveyed, and which are blocked by foliage or other objects not present on the site map (Shown by the middle figure below).

The spectrum analyser will be centered at 1420 MHz, with a span of 5 MHz, as that is roughly the span that would be covered by an observation of the neutral hydrogen in Andromeda, which due to Doppler shift spreads out the 1420 MHz line from 1420 to 1422 MHz.

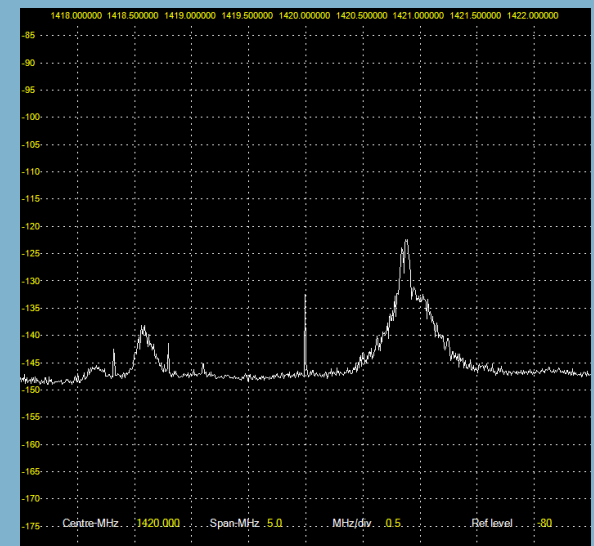
The site with a grid overlaid, using the Moses Holden Telescope building as a reference for the grid, which makes each point 6.5m apart.



A survey of each of the points, with green showing points that are accessible, and red points that are not.



An example of the spectra at 1420 MHz, taken at home, with a span of 5MHz (2.5 MHz each side).



Future Plans

A survey at each of the points shown of the previous will be good to see if there are any permanent sources of interference, but a longer term survey would be needed to fully understand the radio environment of the site. For example as shown below, the analyser was left for a few hours, and the spectrum changed dramatically.

One potential avenue would be to create an RFI survey station, using a raspberry Pi or other small computer that can monitor the site 24/7. This would mean that if a telescope is built, any results can be compared against the stations recordings, to see if a signal is interference or an actual observation.

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Antenna:

www.aaronia-shop.com/products/broadband-antenna-omnilog-90200

SDR Receiver and Spectrum Analyser Software:

www.sdrplay.com

Alston Observatory:

www.star.uclan.ac.uk/observatories/alston-observatory

