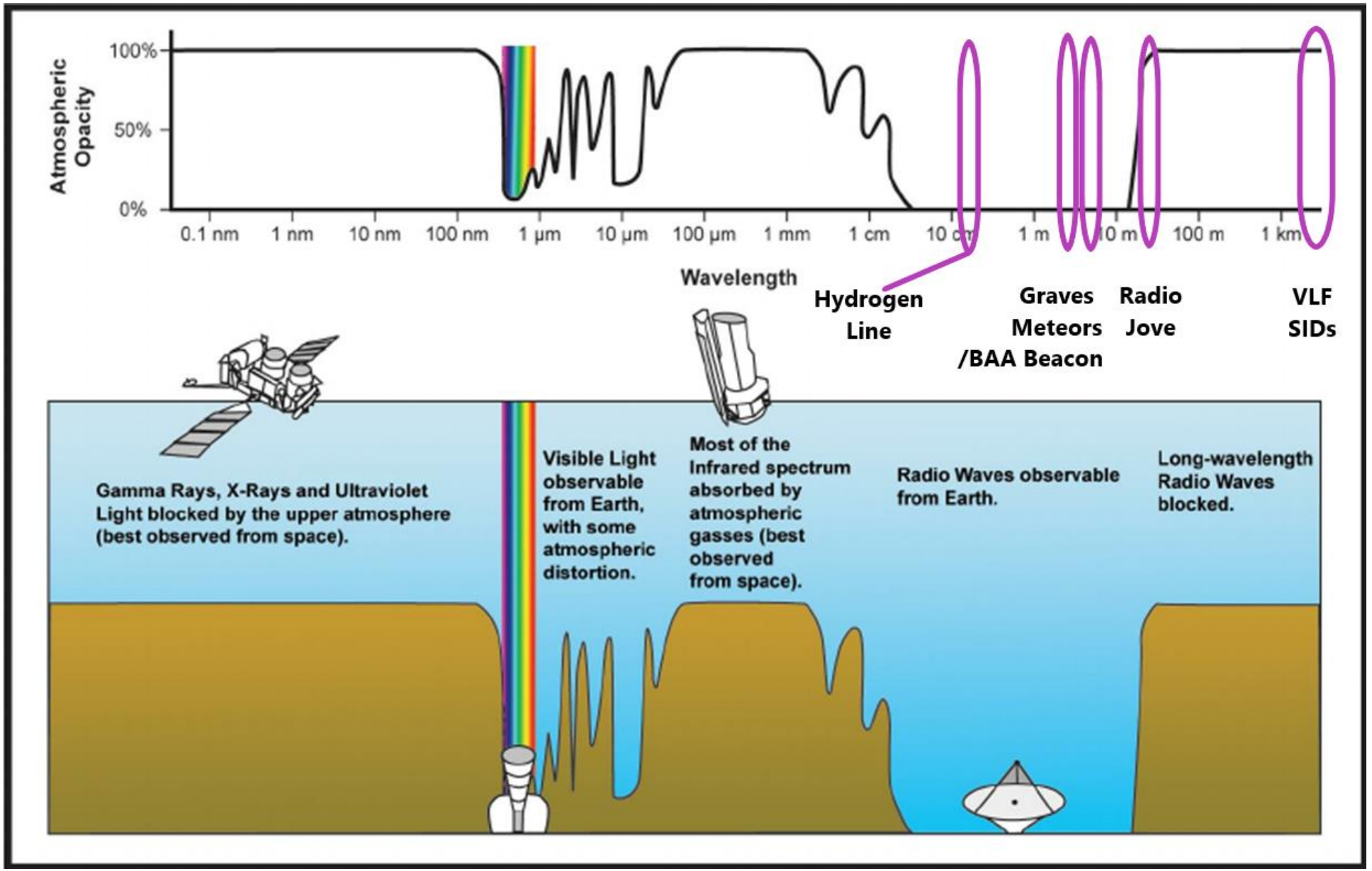
Proposed radio astronomy projects for Walsall Astronomy Society

Dr Andrew Thornett



Location of radio astronomy projects on electro-magnetic spectrum

I would recommend starting with
Projects designed by NASA and SARA for schools
And projects for amateur from UKRAA/BAA

What projects can an amateur astronomer do in their backyard?

- Listen to amateur radio on ISS.
- Record meteors and measure peak of showers even if in daytime.
- Detect solar flares as they hit the atmosphere.
- Record radio emissions from Jupiter.
- Detect hydrogen line in the Milky Way.

I will go through projects one by one and list what club would need to purchase.

- There are usually other options than products I have listed, and aerials can often be built in-house if preferred – these could work better than off-the-shelf alternatives, and are likely to be lot cheaper.
- In addition to products stated below, club would also need:
- Coaxial cable, ***rated for wavelength under investigation***. (You **can't** use RG58 for 1420MHz H-Line work, but you can for meteors).
- Coaxial cable connectors and adapters.
- An old PC running Windows 10 or 11, e.g. Intel i5 with 8GB RAM and 256GB SSD works well, does not need good graphics card, must be able to be left plugged in and turned on 24/7.
- Useful to have a working internet connection to the PC.
- Maybe some other things I haven't thought of…….

Listening to Amateur Radio on ISS

Frequencies for Amateur Radio ISS contacts (QSOs):
1. Voice and SSTV Downlink: 145.80 MHz (Worldwide) (Receive ONLY)
2. Voice Uplink: 144.49 MHz for ITU Regions 2 & 3 (Americas, Pacific, Southern Asia)
3. Voice Uplink: 145.20 MHz for ITU Region 1 (Europe, Russia, Africa)
4. VHF Packet Uplink & Downlink: 145.825 MHz (Worldwide)

BAOFENG GT-5R Dual Band Wa

www.amazon.co.uk/GT-5R-Upgraded-430-440MHz-Handheld-Compatible-Black/dp/B0FKB5K77H/ref=sr_1_1_sspa?crid=149ZXI9816M87&dib=eyJ2IjoiMSJ9.z6QAi9-Eo2SnuyBw_IuMBylHWPRhedW9GIIcWkz8

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Brand	BaoFeng
Colour	Black
Number of channels	128
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Frequency range	144-146MHz, 430-440MHz

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Sold by	Radioddity United Kingdom
Returns	Returnable until Jan 31, 2026 or within 30 days...
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£29.99

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Dispatches from: Amazon
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Rain...

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I use one of these SDRs
FUNcube Dongle Pro
Meteor Scatter

FUNcube Dongle Pro+

Part Number: FUNCUBE-PRO-PLUS

Specifications Guaranteed frequency range: 150kHz to 240MHz and 420MHz to 1.9GHz
Typical frequency coverage: 150kHz to 260MHz and 410MHz to...
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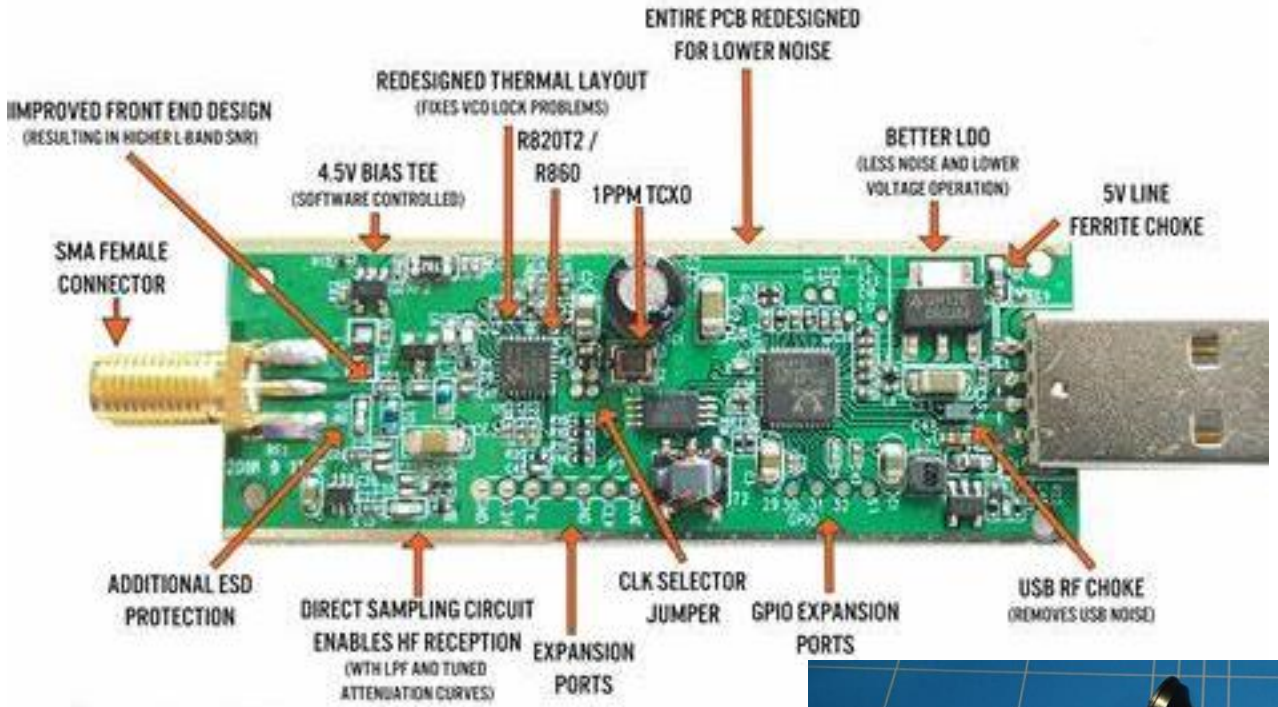

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www.amazon.co.uk/RTL-SDR-Blog-RTL2832U-Software-Defined/dp/B0CD745394/ref=sr_1_1?crid=1QICGHXWD5HQO&dib=eyJ2IjoiMSJ9.i8OJW7n_XWrCPSf5KFauVxx1Sfe0u_msH-VOV2Ffu6wbTXsYRuO

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RTL-SDR Blog V4 R828D RTL2832U 1PPM TCXO SMA Software Defined Radio (Dongle Only)

Brand: RTL-SDR Blog

4.5 ★★★★½ 751 ratings

50+ bought in past month

£41.20

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Get a £40 Amazon Gift Card if approved for The Amazon Barclaycard. Learn more.
Representative 28.9% APR variable. Credit broker: Amazon EU S.A.R.L. Lender: Barclays. T&Cs apply.

Compatible devices	Laptop, Desktop, TV, Smartphone, Tablet, Radio
Connector type	SMA F connector
Brand	RTL-SDR Blog
Connectivity technology	Radio Frequency
Colour	black

About this item

- Includes 1x RTL-SDR Blog R828D RTL2832U 1PPM TCXO HF Bias Tee SMA Dongle (V4) (Dongle Only)
- Several improvements over other brands including use of the R828D tuner, built in HF upconverter circuit, improved filtering,

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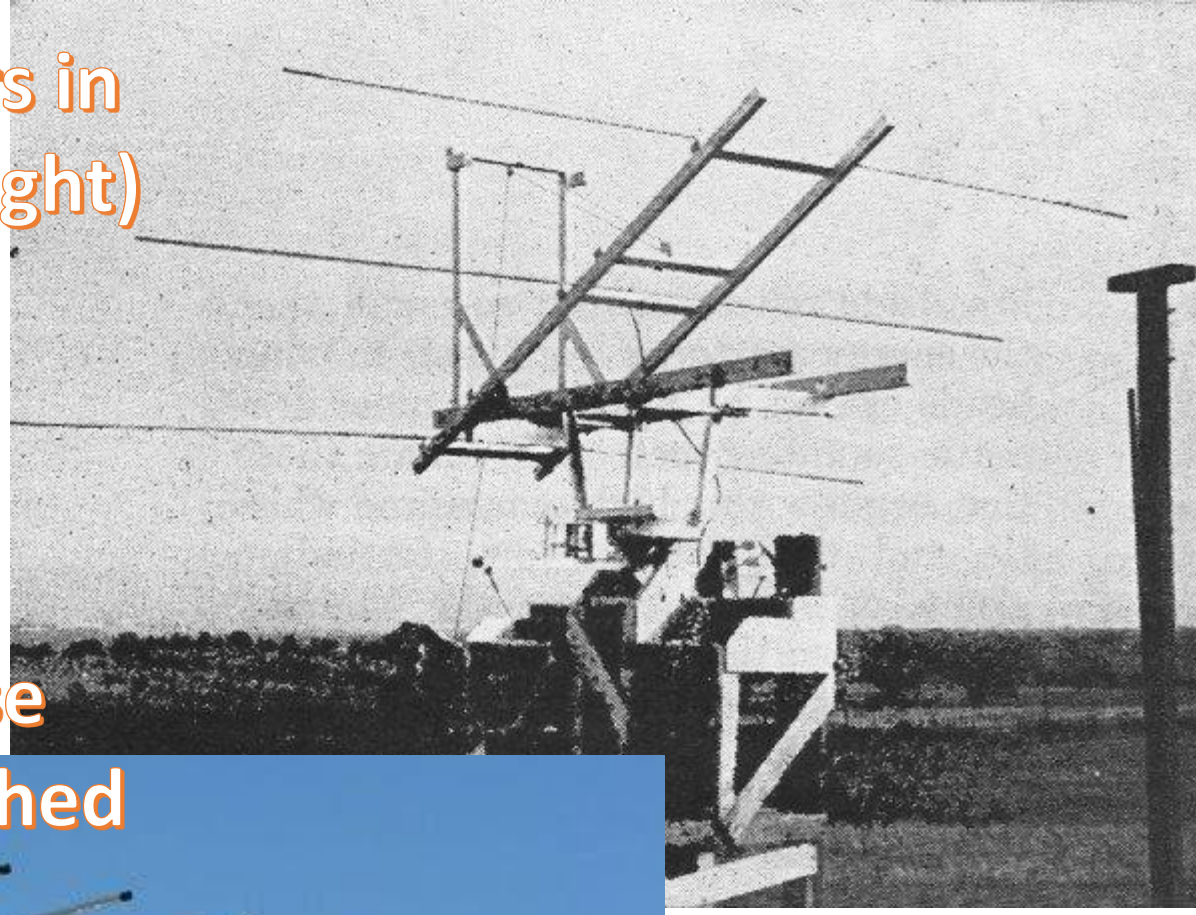
Detecting meteors in 1947 using Yagi (right)

Yagi (below)

Moxon (left) this is what I use mounted on my shed



HB9CV Antenna For 144 MHz Is A Directional Antenna Consisting Of Two Yagi Elements In A Collinear Configuration.

Click the image to enlarge

New

wimo radio products

HB9CV ANTENNA FOR 144 MHZ IS A DIRECTIONAL ANTENNA CONSISTING OF TWO YAGI ELEMENTS IN A COLLINEAR CONFIGURATION.

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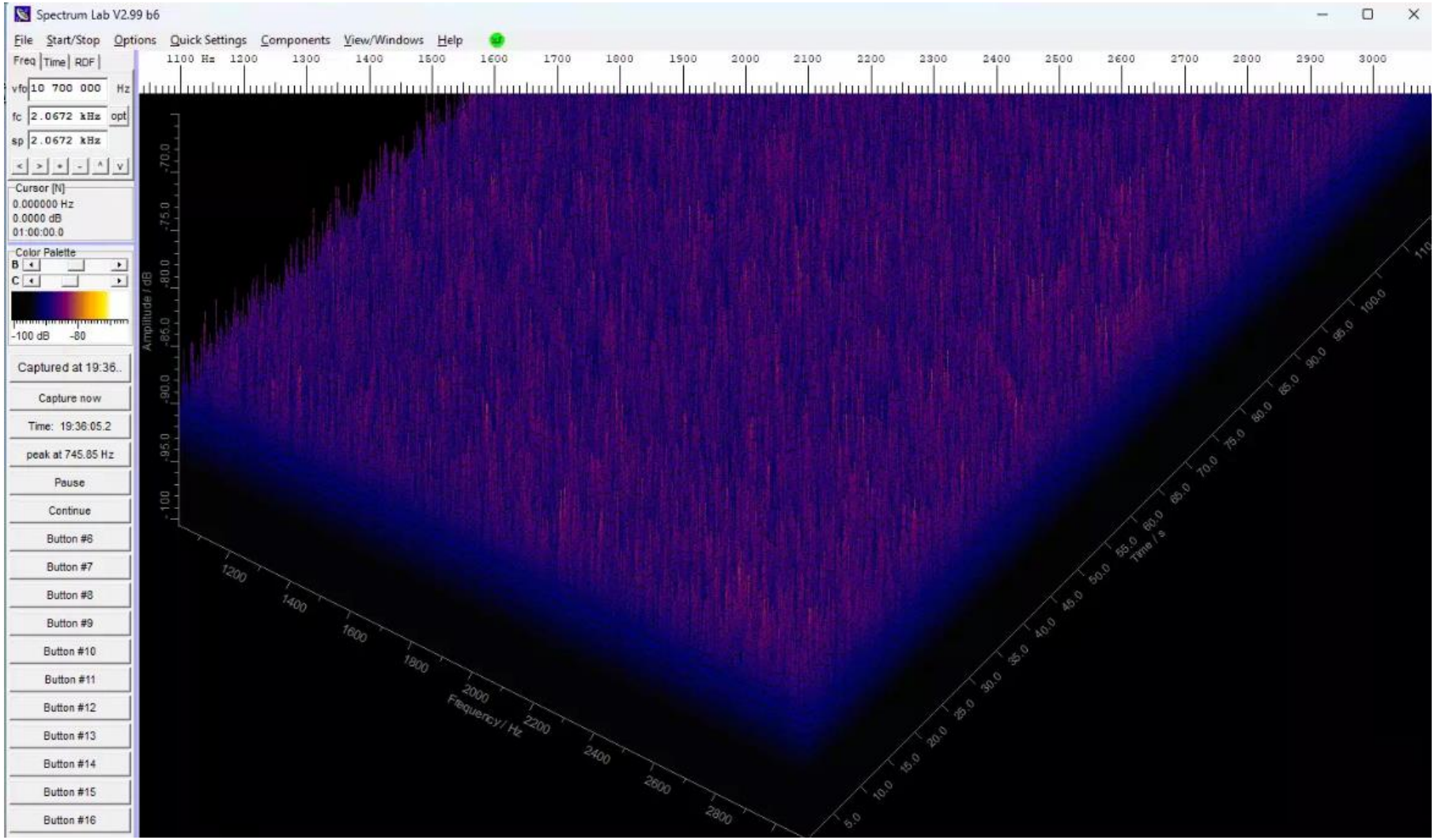
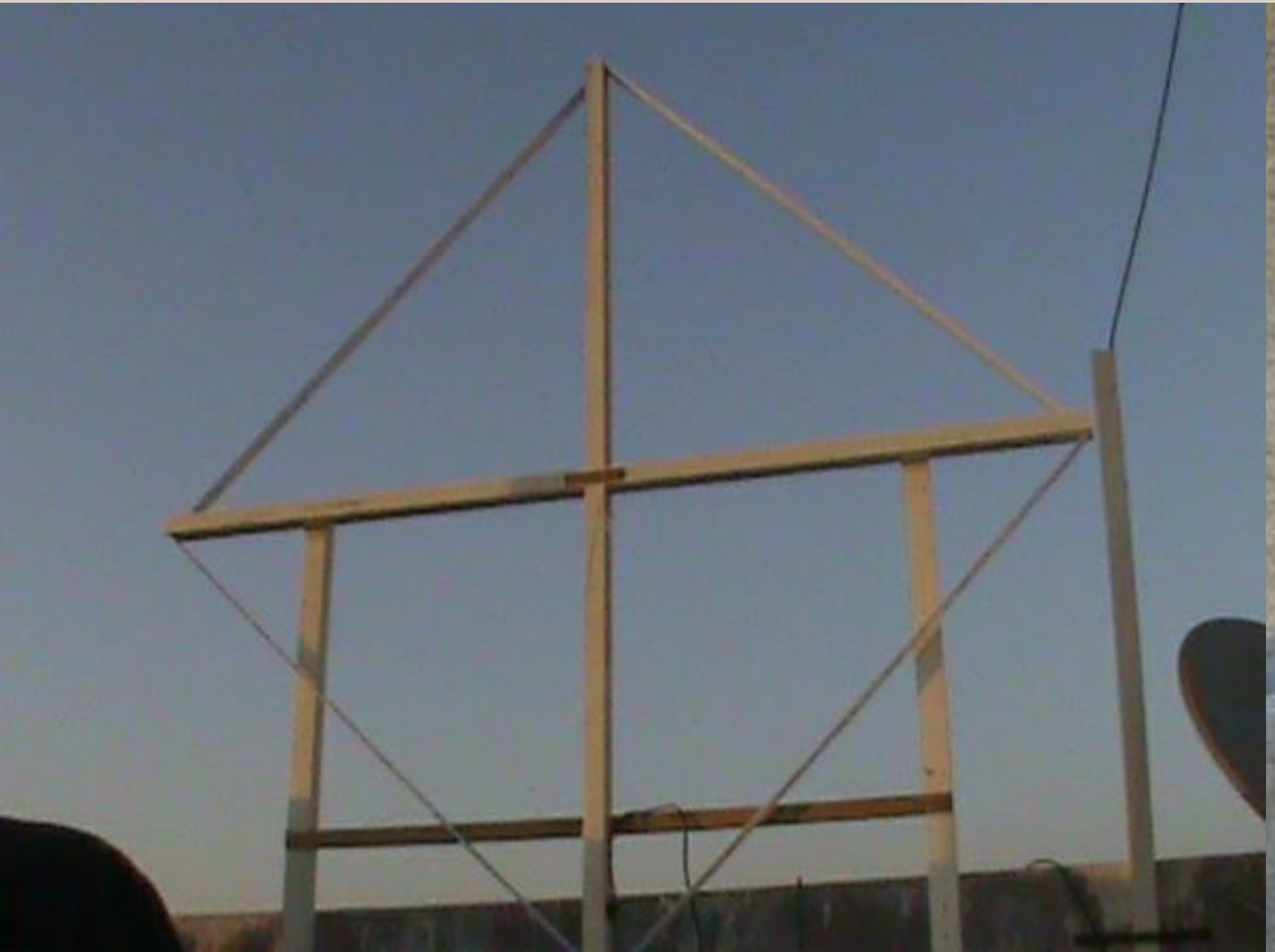
Spectrum Lab



Allows:

- 3D plots
- Waterfall plots
- Conditional action record events
- Audio & visual
- Flexible input source
- Free!

Detection of solar flares that hit Earth (Sudden Ionospheric Disturbances, SIDs)



VLF Receiver

Zoom image

Price: £ 130.00

VLF Aerial Kit with wire

Zoom image

Price: £ 50.00

VLF ATU

Price: £ 43.00

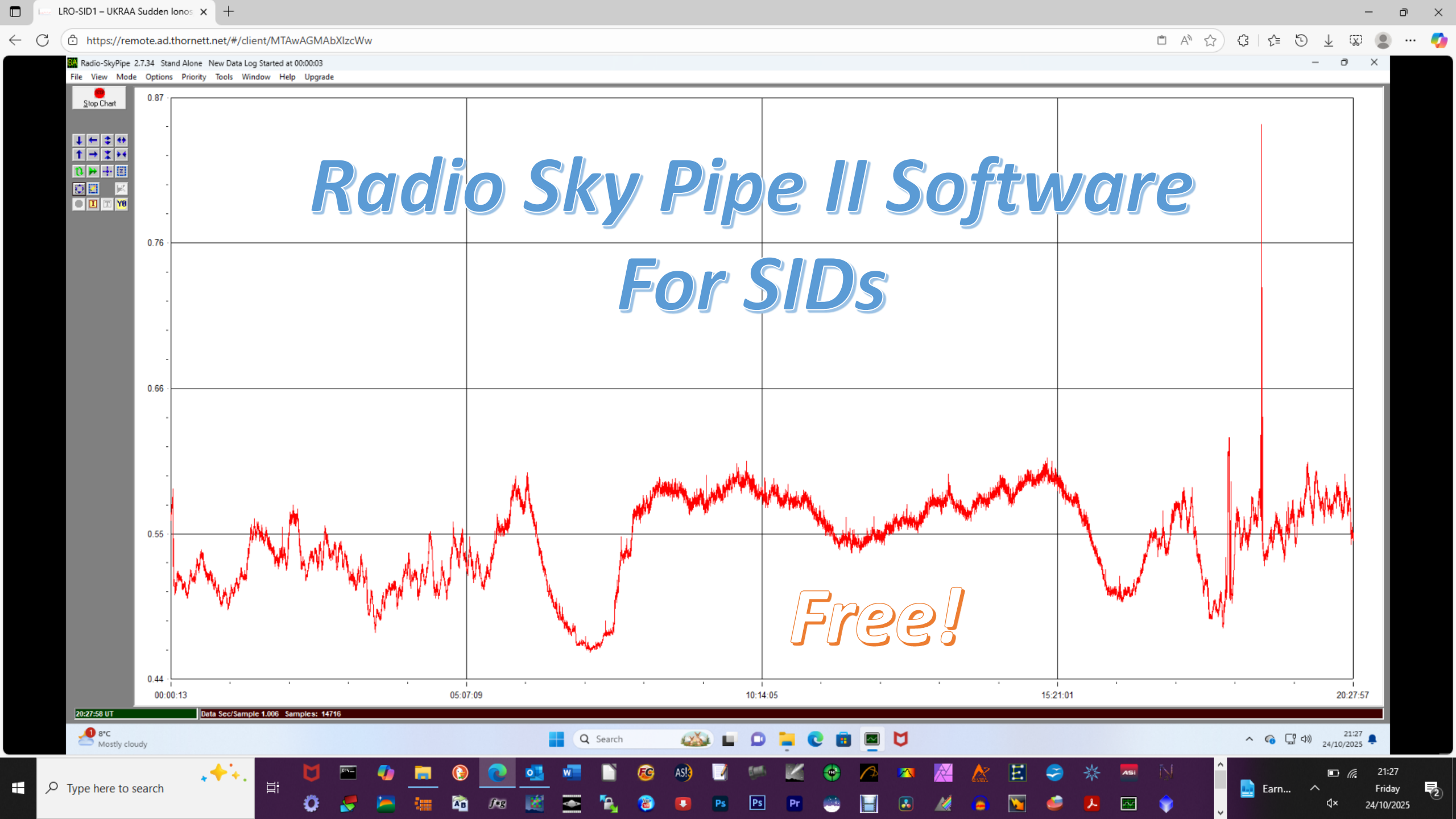
Available

Quantity: 1

Or the American Version…

I will need:

What	*Cost*
SuperSID distribution USB Power	$48 (assembled)
USB Sound card 96 kHz sample rate *(or provide this yourself)*	$40 *(optional)*
Antenna wire (120 meters) *(or you can provide this yourself)*	$23 *(optional) with connectors attached and tested*
RG 58 Coax Cable (9 meters) *(or provide this yourself)*	$14 *(optional) with connectors attached and tested*
Shipping	US $14, Canada & Mexico $40, all other $60
	TOTAL


LRO-SID1 – UKRAA Sudden Ionos
https://remote.ad.thornett.net/#/client/MTAwAGMAbXlzcWw
Radio-SkyPipe 2.7.34 Stand Alone New Data Log Started at 00:00:03
File View Mode Options Priority Tools Window Help Upgrade
Stop Chart
0.87
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0.66
0.55
0.44
00:00:13
05:07:09
10:14:05
15:21:01
20:27:57
Radio Sky Pipe II Software
For SIDs
Free!
20:27:58 UT
Data Sec/Sample 1.006 Samples: 14716
8°C
Mostly cloudy
Search
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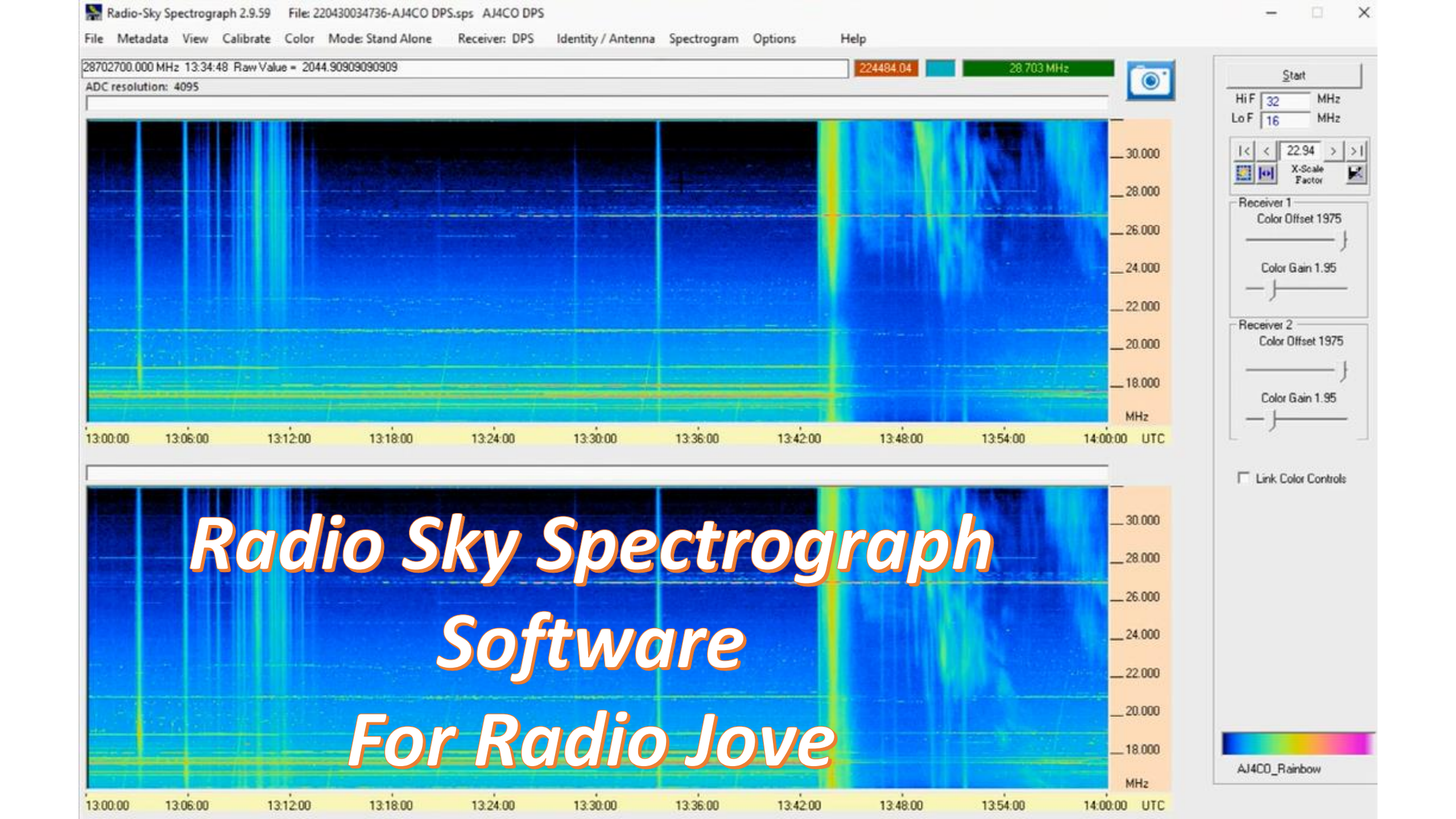
Earn...
21:27
Friday
24/10/2025

Radio Jove: Detect radio emissions from Jupiter & Sun


Radio-Sky Spectrograph 2.9.59 File: 220430034736-AJ4CO DPS.sps AJ4CO DPS
File Metadata View Calibrate Color Mode: Stand Alone Receiver: DPS Identity / Antenna Spectrogram Options Help
28702700.000 MHz 13:34:48 Raw Value = 2044.90909090909
224484.04
28.703 MHz
ADC resolution: 4095
30.000
28.000
26.000
24.000
22.000
20.000
18.000
MHz
13:00:00 13:06:00 13:12:00 13:18:00 13:24:00 13:30:00 13:36:00 13:42:00 13:48:00 13:54:00 14:00:00 UTC
Start
Hi F 32 MHz
Lo F 16 MHz
22.94
X-Scale Factor
Receiver 1
Color Offset 1975
Color Gain 1.95
Receiver 2
Color Offset 1975
Color Gain 1.95
Link Color Controls
AJ4CO_Rainbow
Radio Sky Spectrograph Software For Radio Jove

The Radio JOVE Project

Solar & Planetary Radio Astronomy

Radio JOVE Kits

The Radio JOVE 2.1 Radio Telescope Kit

The Radio JOVE 2.1 Radio Telescope Kit contains the following items: SDRplay model RSP1B radio, a dual-dipole radio antenna, cables and connectors, and SDR Console, SDRc2RSS, and Radio-Sky Spectrograph (RSS) computer software to display and record the data.

Kit Order Form

This SDR receiver, the accompanying Radio-Sky Spectrograph (RSS) software, and the radio antenna, are designed to operate over an 8 MHz wide range of frequencies centered on 20 MHz. This frequency range is optimum for detecting Jupiter decametric radio signals, and is excellent for detecting solar radio emissions, the galactic background from the Milky Way, and natural and artificial Earth-based radio emissions.

[Note: We are often asked if it is possible to use one's own commercially made shortwave receiver for Radio JOVE. It is possible to use such receivers ONLY IF the receiver allows the user to disable the AGC circuit. AGC alters the background noise levels, which distorts the very thing you are trying to observe for Radio JOVE.]

The old Radio JOVE 2.0 Radio Telescope Kit

The SDRplay model RSP1A radio was discontinued in 2024, therefore the Radio JOVE 2.0 Radio Telescope Kit is no longer available.

If you have a working RJ 2.0 system, no change in hardware or software is required. We will continue to support both hardware and software for those participants using the RJ 2.0 system.

The Original Radio JOVE RJ1.1 Receiver Kit

In 1999, the Radio JOVE project designed a simple decametric radio telescope receiver and antenna kit. When completed, this system could receive Jupiter's natural radio emissions, radio emissions from solar storms, and the natural radio background of the Milky Way galaxy. Over 2500 of the RJ 1.1 radio telescope kits have been purchased by schools and amateur scientists world-wide.

Although the RJ 1.1 receivers have been discontinued, the Radio JOVE Project continues to support the hardware and software for these original Radio JOVE receivers.

› Radio JOVE Kits Order Form

› Radio Telescope Equipment Manuals

RADIO JOVE 2.1 RADIO TELESCOPE KIT ORDER FORM

Order Online using PayPal™.
* * * Please allow 2 to 3 weeks for delivery. * * *

IMPORTANT: Before you order the Jove receiver kit and/or the antenna kit, we suggest that you read the on-line manuals. You will need to provide additional materials and tools to complete the antenna. The cost of additional materials for the antenna support structure (masts, etc.) may be in the range of $75 to $100 USD. Also note that the optimal antenna height can be up to 20ft, depending upon your latitude.

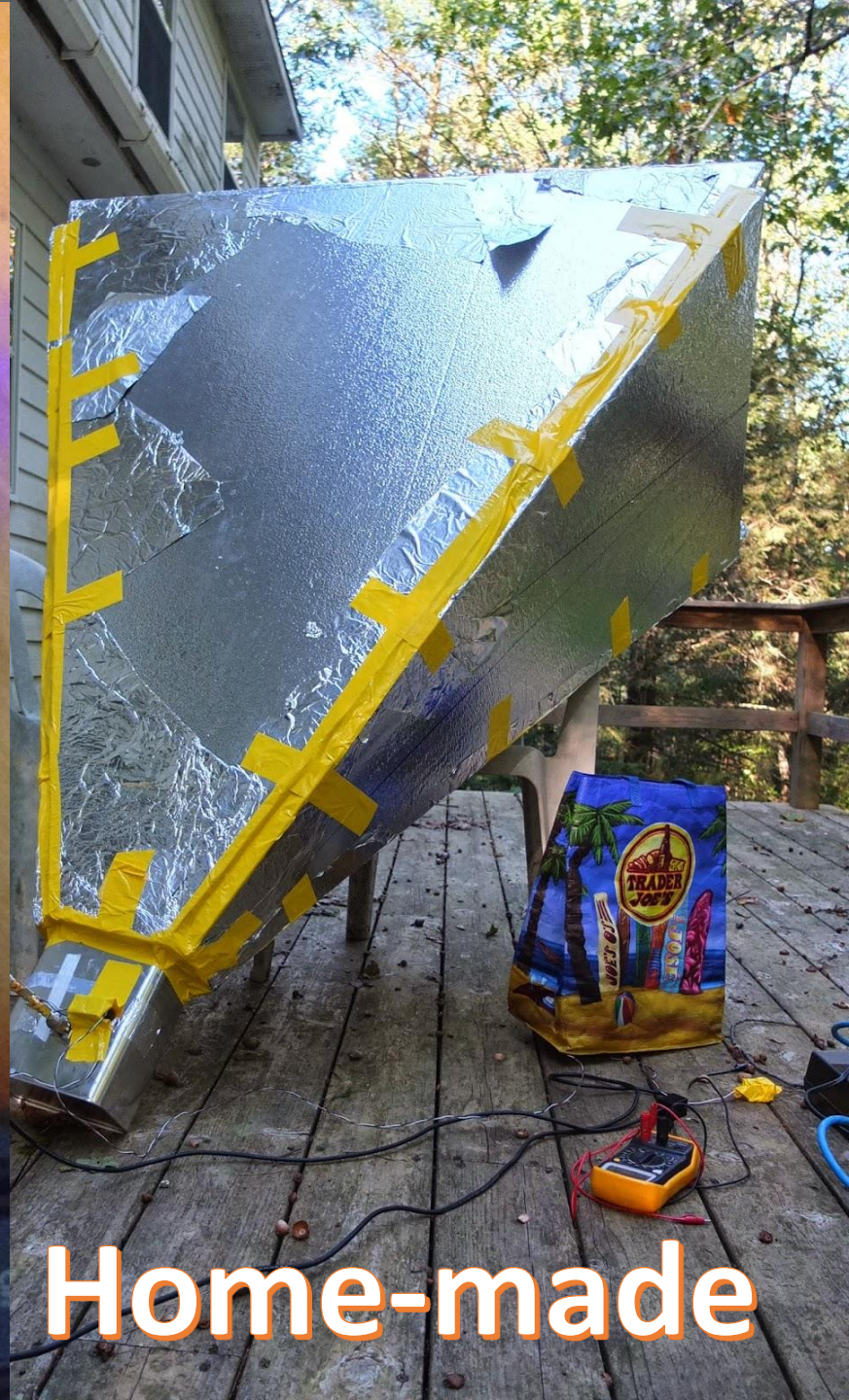
Item # RJK2u: Complete 2.1 Kit = Receiver + Unbuilt Antenna Kit + Software This kit includes the SDR radio SDRplay RSP1B, USB Cable, SMA/BNC cable, F-adapter, unbuilt Antenna Kit (RJA), printed assembly manuals, and Radio-Sky Spectrograph (RSS) software. [Note: Kit does not include antenna support structure.] **Price: $306 + Shipping (See below for shipping fees.)**	**Item # RJK2p: Complete 2.1 Kit = Receiver + Professionally built Antenna Kit + Software** This kit includes the SDR radio SDRplay RSP1B, USB Cable, SMA/BNC cable, F-adapter, Professionally Built Antenna Kit (RJA2), printed assembly manuals, and Radio-Sky Spectrograph (RSS) software. [Note: Kit does not include antenna support structure.] **Price: $472 + Shipping (See below for shipping fees.)**

Hydrogen Line Observing

Off the shelf Nooelec

1.4GHz grid antenna

PARABOLIC MESH ANTENNA



SETI Horn of Plenty

Home-made

Software-defined radio (SDR)
I personally use RTL-SDR Blog V3

Nooelec SAWBird H1 LNA

Currently SAWBird H1 out of stock but will be back soon and similar look and price to these

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Results

Check each product page for other buying options.

NooElec

SAWbird+ NOAA - Premium SAW Filter & Cascaded Ultra-Low Noise LNA Module for NOAA Applications. 137MHz Center Frequency

4.3 ★★★★½ (256)

£43.09

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NooElec

SAWbird iO - Premium Dual Ultra-Low Noise Amplifier (LNA) & Saw Filter Module for Inmarsat Applications. 1542MHz Center Frequency

3.9 ★★★★☆ (19)

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BAOFENG GT-5R Dual Band Wa | RTL-SDR Blog V4 R828D RTL28

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RTL-SDR Blog V4 R828D RTL2832U 1PPM TCXO SMA Software Defined Radio (Dongle Only)

Brand: RTL-SDR Blog

4.5 ★★★★½ 751 ratings

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£41.20

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Get a £40 Amazon Gift Card if approved for The Amazon Barclaycard. Learn more.
Representative 28.9% APR variable. Credit broker: Amazon EU S.A.R.L. Lender: Barclays. T&Cs apply.

Compatible devices	Laptop, Desktop, TV, Smartphone, Tablet, Radio
Connector type	SMA F connector
Brand	RTL-SDR Blog
Connectivity technology	Radio Frequency
Colour	black

About this item

- Includes 1x RTL-SDR Blog R828D RTL2832U 1PPM TCXO HF Bias Tee SMA Dongle (V4) (Dongle Only)
- Several improvements over other brands including use of the R828D tuner, built in HF upconverter circuit, improved filtering,

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Nooelec Satellite Mesh Antenna Bundle for Inmarsat, Iridium, & Hydrogen Line Applications. 20dBi Parabolic Antenna w/ 1.4GHz Center Frequency, 300MHz+ Bandwidth. LMR400 SMA Feed Cable & Mounting Kit

Brand: NooElec

4.3 ★★★★½ 14 ratings

Amazon's Choice

£142.55

Get a £40 Amazon Gift Card if approved for The Amazon Barclaycard. Learn more.

Representative 28.9% APR variable. Credit broker: Amazon EU S.A.R.L. Lender: Barclays. T&Cs apply.

Antenna	Satellite
Brand	NooElec
Colour	White
Number of channels	1

£142.55

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Or fastest delivery **Tuesday, 11 November**. Details

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80cm Folding Aluminium Tripod for Camping Satellite Dishes, Motorhome, Caravan

Brand: Falcon

4.2 ★★★★☆ 39 ratings

Amazon's Choice

£37.49

Get a £40 Amazon Gift Card if approved for The Amazon Barclaycard. Learn more.

Representative 28.9% APR variable. Credit broker: Amazon EU S.A.R.L. Lender: Barclays. T&Cs apply.

Antenna	Satellite
Brand	Falcon
Colour	Silver
Number of channels	1
Number of items	1

About this item

- High quality 80cm aluminium tripod
- Compact folding design
- For use with portable satellite dishes

£37.49

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SDR Sharp with IFAverage Plugin

For folks starting to explore radio astronomy,

ezRA - Easy Radio Astronomy

Free 1420 MHz Galactic hydrogen data collection and analysis

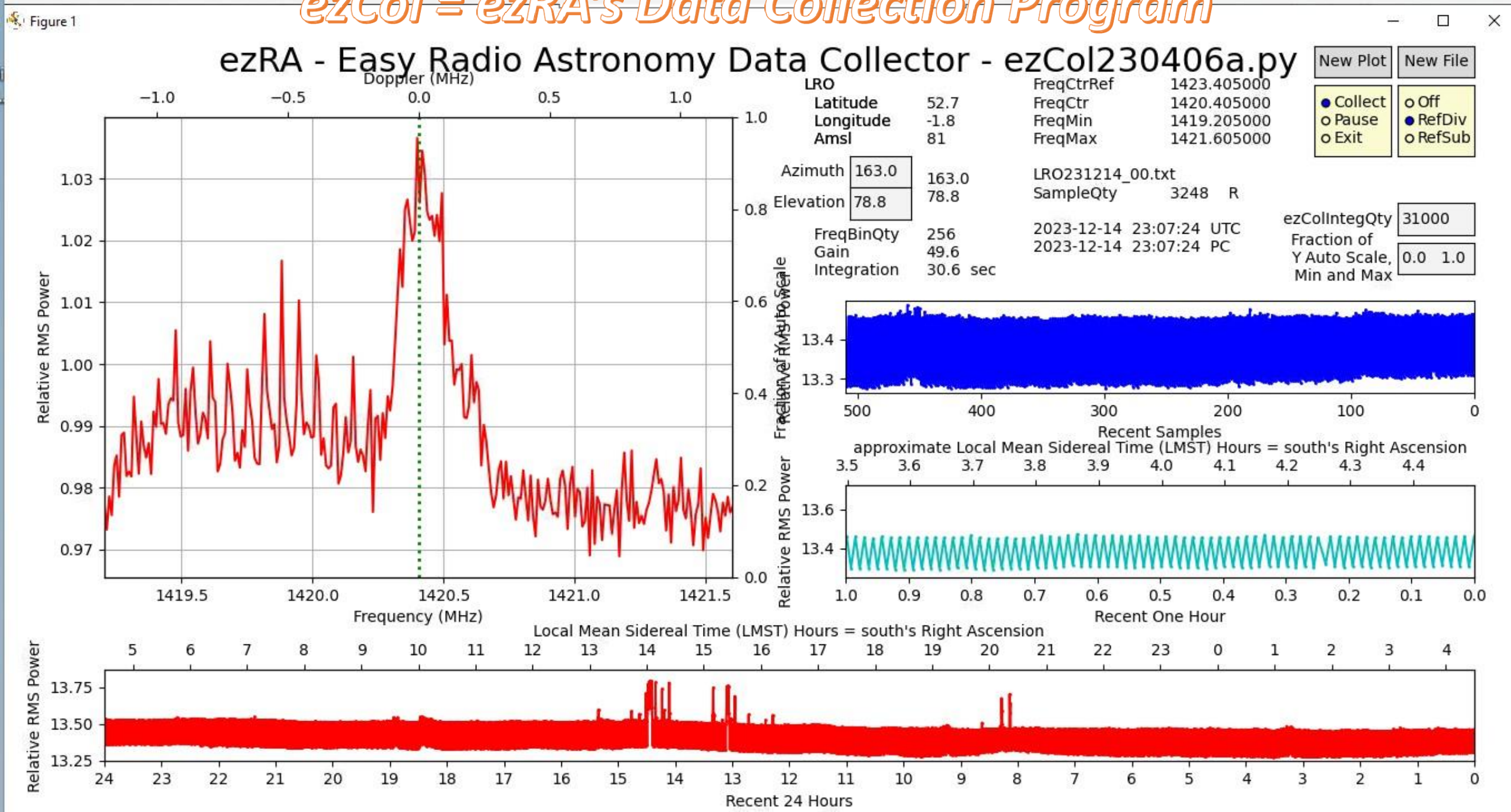
https://github.com/tedcline/ezRA

Windows and Linux

LRO-PharmiganArray (LRO-LAP-03) - RealVNC Viewer

ezCol = ezRA's Data Collection Program

Figure 1

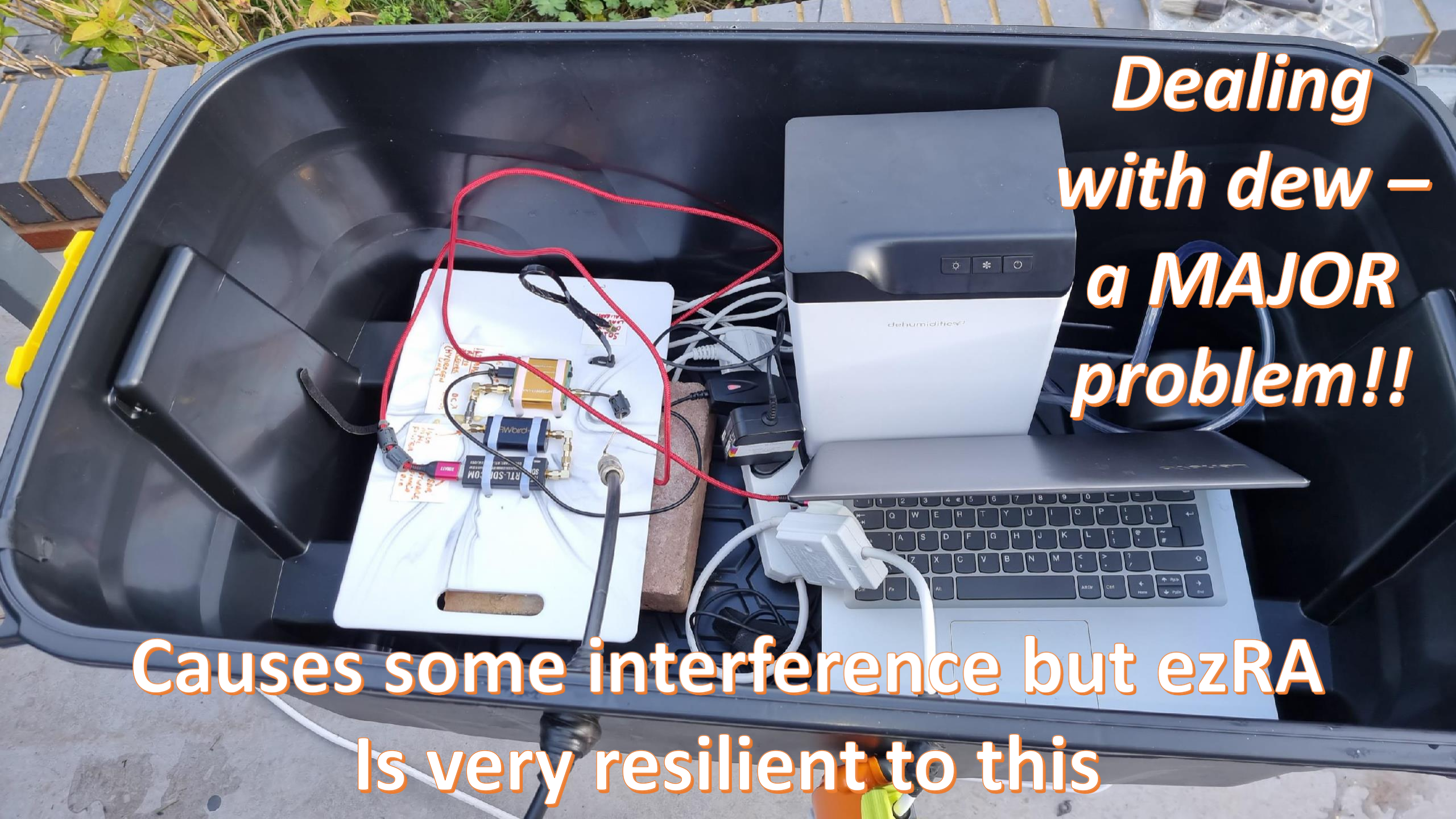


Choosing a PC to record data – I chose Windows-based Mini-PC

- 2nd hand mini-PCs are very cheap - £85 buys off ebay Levono i5, 8GB RAM, 256GB SSD. A little extra increases RAM and SSD.
- Use remote connection to control machines, update software, access live views and download and process data.
- Raspberry PIs, Ardinos, Linux machines are widely used by experienced amateur radio astronomers, depending on software choices – but beginner software largely for Windows only.

Which operating system do we need?

- DL4YHF's Audio Spectrum Analyzer ("Spectrum Lab") is Windows only.
- Radio-SkyPipe is designed for Windows operating systems, specifically from Windows 95 up to the most recent versions like Windows 10.
- Radio-Sky Spectrograph (RSS) software only runs on Windows operating systems, specifically versions 7, 8, or 10.
- Easy Radio Astronomy runs on Windows or Linux (both require Python installation).


Dealing with dew – a MAJOR problem!!
Causes some interference but ezRA
Is very resilient to this


Contact Details:
Dr Andrew Thornett
M6THO
andrew@thornett.net
www.astronomy.me.uk
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