



# VLF Signal Generator

## User Manual



[www.ukraa.com](http://www.ukraa.com)

The UK Radio Astronomy Association  
Company Limited by Guarantee Reg. No. 6481611  
Registered Charity No. 1123866



## Acknowledgements

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The UKRAA VLF Signal Generator was designed by  
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### *Testing Team*

The VLF Signal Generator was tested by  
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The initial batch of the VLF Signal Generators was produced by  
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# Introduction

## UKRAA

The UK Radio Astronomy Association (UKRAA) is a non-profit-making charitable company limited by guarantee. It was established by the Radio Astronomy Group of the British Astronomical Association (BAA) to facilitate the production and sale of radio astronomy products.

Any suggestions or recommendations for improvement of this Manual would be appreciated. See the Contacts page for further details.

## The UKRAA VLF Signal Generator



*The UKRAA VLF Signal Generator*

The VLF Signal Generator has been designed to provide a local signal source for tuning the VLF receiver and the loop aerial to the frequency of military transmitter DHO38 which is located at Ramsloh in Germany. This is the strongest VLF signal in the range of the receiver in the UK, and is at such a range that its signal will normally provide useful ionospheric responses in the event of a Solar flare.

The circuit of the Signal generator is based on the fact that the frequency of the Ramsloh transmitter, 23.4kHz, is close to 6000kHz divided by 256. A simple, cheap ceramic resonator is readily available for 6000kHz, and this may be “pulled” slightly lower in frequency by selecting the right circuit components, to yield the required output from a CD4060 binary divider chip. The output from the frequency divider is buffered by an emitter-follower and fed to the high level output socket, which provides a square wave of approximately 11 Volt amplitude. Purists may observe that there will be many harmonics present in the output signal, but these will all lie above the maximum tuning frequency of the VLF receiver, and so there will be no tuning ambiguities. The high level output is attenuated by approximately 1000:1 with a resistive divider to supply a low level output (approximately 4mV RMS) suitable for connecting directly to the VLF receiver input socket. Both outputs are short-circuit proof, and do not carry any DC voltage level.

Details of the use of the Signal Generator will be found in the manuals for the VLF Receiver, VLF Aerial and VLF Aerial Tuning Unit (ATU).

# Glossary

ATU	Aerial Tuning Unit
RAG	Radio Astronomy Group
RoHS	Restriction of Hazardous Substances
SID	Sudden Ionospheric Disturbance
UKRAA	The UK Radio Astronomy Association
URL	Uniform Resource Locator
VLF	Very Low Frequency
WEEE	Waste Electrical and Electronic Equipment

# References

## Internet URLs

[www.ukraa.com](http://www.ukraa.com)

[www.britastro.org/radio](http://www.britastro.org/radio)

[www.starbase.org.uk](http://www.starbase.org.uk)

[www.czd.org.uk/astro/radioastro/sid/index.html](http://www.czd.org.uk/astro/radioastro/sid/index.html)

[www.sec.noaa.gov/today.html](http://www.sec.noaa.gov/today.html)

[togashef.sheffield.ac.uk/%7Esferix/vlf.png](http://togashef.sheffield.ac.uk/%7Esferix/vlf.png)

[www.iaragroup.org/sole/index.htm](http://www.iaragroup.org/sole/index.htm)

[sidstation.lionelloudet.homedns.org](http://sidstation.lionelloudet.homedns.org)

[www.ptb.de/en/org/4/44/442/dcf77\\_weite\\_e.htm](http://www.ptb.de/en/org/4/44/442/dcf77_weite_e.htm)

[www.aavso.org/observing/programs/solar/sid.shtml](http://www.aavso.org/observing/programs/solar/sid.shtml)

[www.radiosky.com](http://www.radiosky.com)

The UK Radio Astronomy Association

BAA Radio Astronomy Group

Starbase information

Martyn Kinder's BAA SID VLF Receiver

GOES satellite data & space weather

Sheffield VLF Monitor

Italian VLF group

SID Monitoring Station A118

DCF77 Transmitter

American Association of Variable Star Observers (AAVSO)

Radio Sky Publishing

# Contacts

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## Starbase Information

Website: [www.starbase.org](http://www.starbase.org)

## BAA Radio Astronomy Group

Website: [www.britastro.org/radio](http://www.britastro.org/radio)

## Appendix 1 – VLF Signal Generator Specifications

Output Frequency	23.4 kHz
High Level Output	11 Volt square wave
Low Level Output	4 millivolt RMS
Current Consumption	35 mA
Power Supply	15 Volt DC

This Signal Generator requires a 12–15V DC 2.5mm centre pin positive voltage supply. You can use:

- a suitable battery or battery pack;
- the UKRAA 15V regulated power supply or similar;
- the 15V output socket from the UKRAA VLF Receiver.

## Appendix 2 – VLF Signal Generator Circuit Diagram

The VLF Signal Generator Circuit Diagram is available on request from UKRAA. Please see the Contacts section for email and postal addresses.

## Appendix 3 – Regulatory Compliance

### RoHS

The Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2002/95/EC, (commonly referred to as the Restriction of Hazardous Substances Directive or RoHS) was adopted in February 2003 by the European Union. The RoHS directive took effect on 2006 July 1, and is required to be enforced and become law in each member state. This directive restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment. In speech, RoHS is often spelled out, or pronounced “rosh”.

The above paragraph was taken from the Wikipedia essay on RoHS.

The RoHS Directive restricts the use of the following six hazardous substances in electronic and electrical equipment products falling within the Directive:

- Lead
- Mercury
- Cadmium
- Hexavalent chromium
- Polybrominated biphenyls
- Polybrominated diphenyl ethers

UKRAA confirms that the suppliers of the components and materials used in the UKRAA VLF Receiver have stated that such components and materials are RoHS compliant and that reasonable steps have been taken to confirm these statements.

### WEEE

RoHS is closely linked with the Waste Electrical and Electronic Equipment Directive (WEEE) 2002/96/EC that sets collection, recycling and recovery targets for electrical goods and is part of a legislative initiative to solve the problem of huge amounts of toxic e-waste.

The Waste Electrical and Electronic Equipment (WEEE) Directive is designed to ensure the efficient collection and recycling of electrical and electronic equipment at end-of-life. If a customer purchases a new product from UKRAA which falls within the WEEE Directive to replace an existing one (of similar function to the one that has been sold) and intends to dispose of the existing one, then the customer can request that we take back the existing product and deal with the costs and logistics of recycling it. Any customer wishing to take advantage of this facility should contact us. Provided that the existing product comes within the scope of the WEEE Directive, we will make arrangements for its return or collection and will deal with its disposal.



## Revision History

Revision	Date	Author	Status
Draft A	2009-12-14	L M Newell	Internal draft for peer review
Issue 1	2010-01-12	L M Newell	Incorporated reviewer's comments

## Outstanding Work

None, document is at Issue status



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