Having used a Wellbrook Communications ALA1530 magnetic loop antenna for more than 15 years, Mike Richards takes the opportunity to test the latest version of this well respected antenna.

■ Mike Richards tests the latest magnetic loop antenna from Wellbrook


The Wellbrook ALA1530S+ Imperium antenna.

# Wellbrook ALA1530S+ Imperium

**Wellbrook Communications magnetic loop antennas have become something of a standard in the world of receiving antennas and have been in use extensively by professionals and hobbyists alike for many years.** In this review, I will be looking at the latest variant of the ALA1530 series, the ALA1530S+ Imperium. This builds on the standard ALA1530 to provide better intermodulation performance, higher gain and an improved signal to noise (SNR) ratio.

## The Theory

While there have been many active antenna designs, in my opinion, Wellbrook loops have reigned supreme for the past 15 years. To understand why, you need to look into the workings of magnetic loop antennas.

Radio signals have both magnetic and electric field components. While most wire antennas are sensitive to the electric field, the magnetic loop antenna is configured to reject the electric field and respond only to the magnetic field. Some antennas do this by enclosing the loop windings inside an aluminium tube. However, the Wellbrook design uses the aluminium tube itself as the low impedance loop element. This loop is then forced to have a 180° phase difference by the balanced amplifier. As a result, the incident electric field cancels out due to the small size of the loop when compared to the signal wavelength. The net result is that the antenna is primarily sensitive to the magnetic field.

You might be wondering why bother to reject the electric field element of the radio wave. The answer lies in interference rejection. At their origin, radio waves tend to have a much stronger electric field than magnetic field. This is especially true of many of the more common interference sources that plague the medium wave and HF spectrum. By rejecting the electric field, a well-designed magnetic loop antenna can deliver a much improved SNR compared with that obtained when using an active or a passive wire antenna.

Designing a broadband un-tuned magnetic loop is not easy and you will note that many manufacturers opt for tuned designs where you have to manually tune the antenna for each operational frequency. These designs often require the loop to be positioned close to the receiver, which inevitably means they are also closer to interference sources. The tuned loop also poses a problem for listeners using modern software defined (SDR) receivers, where the display bandwidth can be 1MHz or more. In these cases, the tuned antenna artificially limits the spectrum that can be seen on the display.

## The Wellbrook Solution

The secret of the Wellbrook design is to use an antenna aperture that's small (one metre) when compared with the signal wavelength, combined with the aluminium tube low inductance loop element. Even with this combination, there are potential problems because the impedance of the loop element will vary with frequency. This impedance variation could reduce the power transfer as the frequency increases. The Wellbrook solution is to employ a specially designed impedance tracking balanced amplifier to ensure optimum impedance matching of the loop throughout the operational range (50kHz to 30MHz). **Fig. 1** shows a simplified block diagram of the loop, the impedance tracking low noise amplifier, the feeder and the 9dB balanced Norton amplifier.

In addition, the loop has directional properties with its figure of eight reception pattern. The nulls in the reception pattern can be used to help reject interference sources such as strong adjacent channel signals. When using an active antenna such as the ALA1530S+, it is vital that the strong signal performance is at least as good as your receiver. The ALA1530S+ is pretty 'bullet proof' in that respect because the medium wave third order intercept point is now +55dBm and the second order is +90dBm! The latest model also has a VHF/FM filter fitted to prevent out of band overload from local VHF/FM transmitters.

## In the Box

The design of the antenna doesn't really suit transportation in a box, so the antenna arrived well packed using pipe insulation to protect the loop element. In addition to the loop with its built-in amplifier module, the ALA1530S+ comes with an Antenna Interface (a power feed unit) and a good quality regulated power supply. The Antenna Interface contains a balanced 9dB Norton amplifier and has a BNC socket to accept the loop feeder (not provided) and a one metre BNC terminated lead to connect to your receiver – see **Fig. 2**. The power supply connects via a standard coaxial power socket and there is a small light emitting diode (LED) to show that the unit is powered up. For mounting the antenna, a flange and short aluminium stub are provided in the pack. The electronics for both the radio frequency (RF) amplifier and the power feed units are epoxy resin encapsulated (**Fig. 3**), thus making them extremely rugged and weatherproof.

## Installation

There are many ways to mount the loop, including using a block of wood to install it at ground level. While performance is at its best when mounted as high as possible, it is still an excellent antenna at ground level. Being just one metre in diameter, it takes-up minimal space. Therefore, it's suitable for just about any location. If you're really stuck for space, Wellbrook even make a loft mountable loop – the LA5030. However, the ideal location is out in the open and as far as possible from sources of man-made noise.

If you are interested in the low and medium frequency (LF/MF) bands, then an antenna rotator of some form is recommended, so you can take advantage of the loop's directional properties to null out unwanted stations or noise sources. The antenna's mechanical load is very low, so you will only need a small rotator.

As the operating frequency increases, the arrival angles of the signals increase, so the antenna becomes increasingly omnidirectional – see **Fig. 4**.

The feeder from the loop to the Antenna Interface is not supplied but can easily be constructed from a length of suitable coaxial cable with BNC plugs at each end. The signal and power feeds use the same coaxial feeder, so there is just a single cable between the loop and the Antenna Interface. The recommended feeder is standard RG-58C coaxial cable – it's widely available for approximately 50 pence per metre or £40.00 for a 100 metre drum. Feeder length can be anything up to 100 metres but the shorter the better.

Weather protection for the BNC connector at the antenna is by a rubber boot (supplied). However, I use Contralube 770 to protect all my antenna connections. Contralube 770 is a waterproofing gel that was developed for the automotive industry. When applied to an electrical connector, the gel moves away from the microscopic contact points but prevents the ingress of dirt and moisture. The gel is safe to use on RF and small signal circuits, so it is ideal for this application.

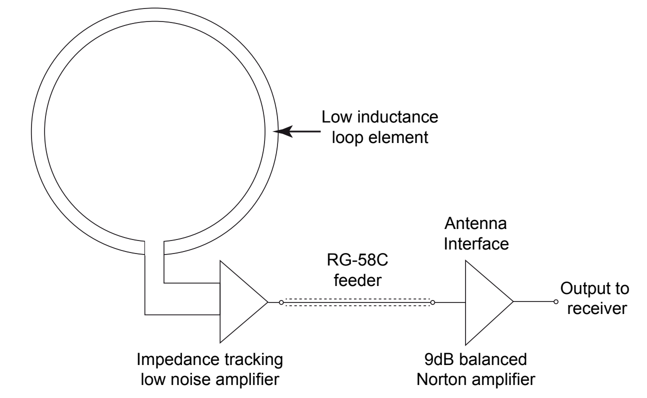


**Fig. 1: A block diagram of the ALA1530S+ antenna system.**


**Fig. 2: The ALA1530S+ Antenna Interface unit.**

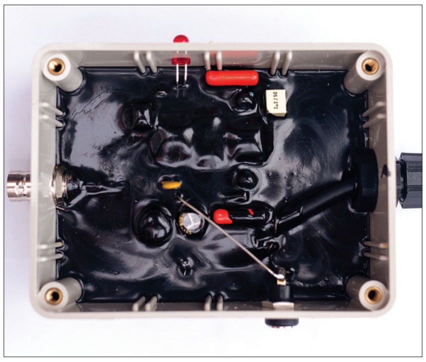

**Fig. 3: Inside the ALA1530S+ Antenna Interface unit.**

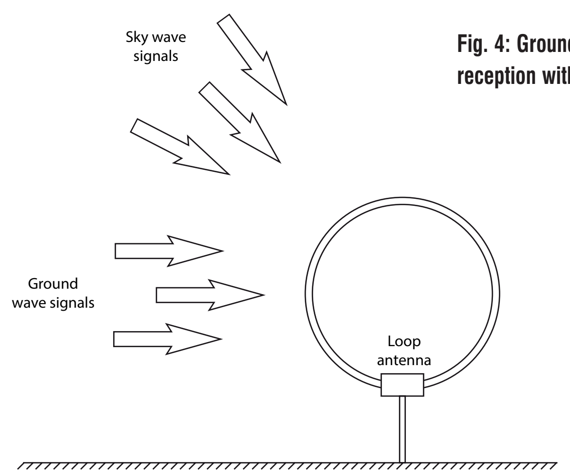


**Fig. 4: Ground wave versus sky wave reception with a loop.**

## Performance

As I've mentioned in previous reviews, accurately assessing antenna performance is very difficult. Therefore, I've concentrated on a few comparative tests designed to show a prospective buyer the likely benefit of upgrading.

I started by looking at the directional properties of the antenna. The technique I used was to tune to a strong station and then rotate the antenna and observe the effect.

On long wave, I started with Radio 4 on **198kHz** which was coming in at a thumping +60dB over S9! By rotating the antenna, I observed a very sharp null of approximately 30dB. I also tried tuning between long wave stations to see if the noise could be nulled by rotating the loop. However, there was very little difference in noise level and this is almost certainly because I live on a housing estate, so my local interference is coming from all directions!

I then moved up to medium wave and monitored the antenna's performance on Radio Jersey (**1026kHz**). Again, I saw a sharp 25dB null through rotating the antenna.

As I moved up into the HF bands, the signal nulls became softer and less well defined. This is due to many of the signals being received via sky wave propagation as opposed to the largely ground wave propagation on the long and medium wave bands. However, at the higher frequencies I did find that the noise sources appeared to be more directional.

As I rotated the antenna, I could reduce the noise while the wanted signal remained fairly constant. This is useful because it's the difference between the signal and noise levels that are important and rotation enabled me to reduce the noise and so improve the overall signal quality.

If you want to avoid using a rotator with the ALA1530S+, you could pick a favourite band, adjust the antenna position for the lowest noise and just leave it there.

For the next test, I wanted to compare the ALA1530S+ with the type of antenna a beginner might be using. As with the tests I did recently on the Cross Country Wireless HF Active Antenna, I set up a simple antenna using a 10-metre length of wire. I then tuned to a number of broadcast stations and measured the carrier level and the noise floor for the wire antenna and the ALA1530S+. The results are shown in **Table 1**. As you can see, the ALA1530S+ provided a significant improvement throughout the frequency range. At many of the test frequencies, the ALA1530S+ reduced the noise floor while at the same time increasing the signal level. The net result is some impressive SNR improvements. You will see that the improvement reduces at the 11MHz reading and then increases again at higher frequencies. This is because the wire antenna resonates around that frequency so starts to behave like a decent antenna, albeit briefly!

The final test was to compare the new ALA1530S+ with my own (original) ALA1530. This antenna has been in use here for around 15 years and has seen no maintenance other than the occasional renewal of the feeder and packing the connector with Contralube. To make the comparison fair, I used new feeders of exactly the same length for both the old and new antennas. The coaxial outputs of the antennas were fed to a two-way antenna switch so I could make the A:B performance comparisons. The new ALA1530S+ boasts a higher gain than the original unit. Therefore, to compensate for that I included a high quality switched attenuator between the ALA1530S+ and the A:B switch. Using this I could adjust the output level so that both antennas delivered the same signal level to the receiver. The gain difference was approximately +12dB at low frequencies rising to +16dB at 21MHz. I then tuned to a number of AM broadcast stations between long wave and the higher short wave bands and measured the difference between the signal carrier and the noise floor for both antennas. Working with the lousy band conditions of late this was a tricky exercise but most of the measurements showed a 3dB to 5dB SNR improvement with the new antenna. This was about what I expected given the design changes that have been made since the original antenna was launched. The good news was that the tests confirmed that my 15-year-old antenna was still working to specification. This is a testament to the legendary design and build quality of Wellbrook antennas and shows you can expect to see many years of reliable service.

I found the extra gain of the ALA1530S+ to be very useful because it comes with an improved noise level, so is genuinely useful gain. During my general listening tests, I encountered several occasions where the ALA1530S+ was able to extract weak signals that were not audible with the old antenna.

While testing, I tried the ALA1530S+ with the FUNcube Dongle Pro+ (FCD) and it proved to be a very good match on most bands. However, the high output level did drive the FCD into overload when receiving S9 +60dB signals on long wave! Not surprising really but this was easily solved by disabling the Mixer gain on the FCD or switching an attenuator in the antenna lead.

## summary

The new ALA1530S+ maintains the high build quality and excellent performance of this range of antennas. The additional gain of the ALA1530S+ is very welcome. However, if you're using this antenna with one of the popular wideband SDR receivers or scanners, you might need to have a switchable attenuator in line to deal with very strong signals that can be found on the broadcast bands. Performance on the long and medium wave broadcast bands was exceptional and the directional properties of the antenna can be really helpful when hunting down weak DX stations. Across the rest of the bands, the ALA1530S+ was first class and it is easy to see why this antenna is so well respected.

The ALA1530S+ Imperium costs £250.00 and is available from **Wellbrook Communications, The Farthings, Beulah, Llanwrtyd Wells, Powys LD5 4YD**. Telephone: **01591 620316**. www.wellbrook.uk.com

My thanks to Wellbrook Communications for the loan of the review model.

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**Table 1: Wellbrook ALA1530S+ Compared with a 10-metre Wire Antenna**

| Frequency | Wire Antenna | | ALA1530S+ | | SNR Improvement | Signal Level Improvement |
|---|---|---|---|---|---|---|
| | Carrier | Noise | Carrier | Noise | | |
| 198kHz | -40dBm | -85dBm | -10dBm | -88dBm | 33dB | 30dB |
| 693kHz | -28dBm | -75dBm | -5dBm | -85dBm | 33dB | 23dB |
| 1.197MHz | -26dBm | -68dBm | -10dBm | -75dBm | 23dB | 16dB |
| 6.095MHz | -32dBm | -68dBm | -22dBm | -75dBm | 17dB | 10dB |
| 11.52MHz | -40dBm | -80dBm | -35dBm | -80dBm | 5dB | 5dB |
| 13.665MHz | -35dBm | -78dBm | -25dBm | -78dBm | 10dB | 10dB |
| 15.13MHz | -45dBm | -85dBm | -35dBm | -85dBm | 10dB | 10dB |
| 17.67MHz | -55dBm | -82dBm | -45dBm | -88dBm | 16dB | 10dB |
| 21.525MHz | -50dBm | -85dBm | -40dBm | -85dBm | 10dB | 10dB |