9el 144MHZ LFA YAGI ASSEMBLY & INSTALLATION MANUAL

WARNING

EXTREME CAUTION SHOULD BE TAKEN WHEN CONSTRUCTING AND ERECTING ANTENNA SYSTEMS NEAR POWER AND TELEPHONE LINES. SERIOUS INJURY OR DEATH CAN RESULT IF THE ANTENNA COMES INTO CLOSE PROXIMATEY TO OR TOUCHES THE ABOVE MENTIONED LINES.

ALWAYS WEAR PROTECTIVE CLOTHING, HARNESSES AND HARD-HATS WHEN CONDUCTING ANTENNA INSTALLATIONS UPON TOWERS OR MASTS AND DOUBLE CHECK ALL CONNECTIONS AND FITTINGS UPON THE ANTENNA PRIOR TO FINAL INSTALLATION.

NEVER INSTALL AN ANTENNA DURING A THUNDER STORM, DURING WINDY CONDITIONS OR NEAR OVERHEAD POWER LINES.

Contents

The LFA Yagi Antenna

Congratulations on choosing the LFA Yagi by InnovAntennas. You have chosen one of the most sophisticated and innovative directional antennas available today and rest assured your new antenna will provide you with many years of outstanding and trouble-free performance due to the quality components and manufacture processes used by InnovAntennas.

The LFA Yagi has been specifically designed to reduce unwanted natural and man-made noise while at the same time, provide a high-performance antenna with a 50Ohm direct feed driven element system resulting in no matching loss. Typically, antennas using matching devices such as gamma, T-match, Hairpin (etc.) will incur losses of between .3 and .5dB which are NOT presented in gain figures. With the LFA, all performance figures presented are 'what you get' figures!

The LFA Yagi is designed with a view to ensuring minimum side lobes and maximum rearward suppression too. This ensures unwanted signals (from directions other than the direction the antenna is facing) are drastically reduced. The closed loop feed system the LFA deploys, ensures man-made and static noise (including rain static) are drastically reduced in the same way as quad antennas does so.

As elements are added to a Yagi, Impedance drops and it is for this reason matching devices are added to transform the Yagi feed impedance back to the 50Ohm required by the coax feed-line. The unique design of the LFA loop means that as well as being the radiating element, the loop is also the impedance transformer too and as such, no other foreign object or matching device has to be added to the antenna and therefore, any matching losses and pattern distortion caused by such a device are not seen with the LFA Yagi. A simple choke balun (a few turns of coax at the feedpoint) is all that is needed to ensure a true balance with no RF returning along the outer sleeve of the coax cable feed-line.

At InnovAntennas we hope you will enjoy many trouble-free years of service from your new LFA Yagi and hope that our Limited 5 year Warranty* will provide you with piece of mind too.

If you have any questions about your LFA, would like to share your experiences or read about the experiences of others, Email: support@innovantennas.com to register and you will receive a user name and password in order to login and use our on-line support forum.

*The InnovAntennas Limited 5 year warranty includes the failure of parts excluding wind damage or damage caused by adverse weather conditions.

9 element 144MHz (4.43m) LFA Yagi

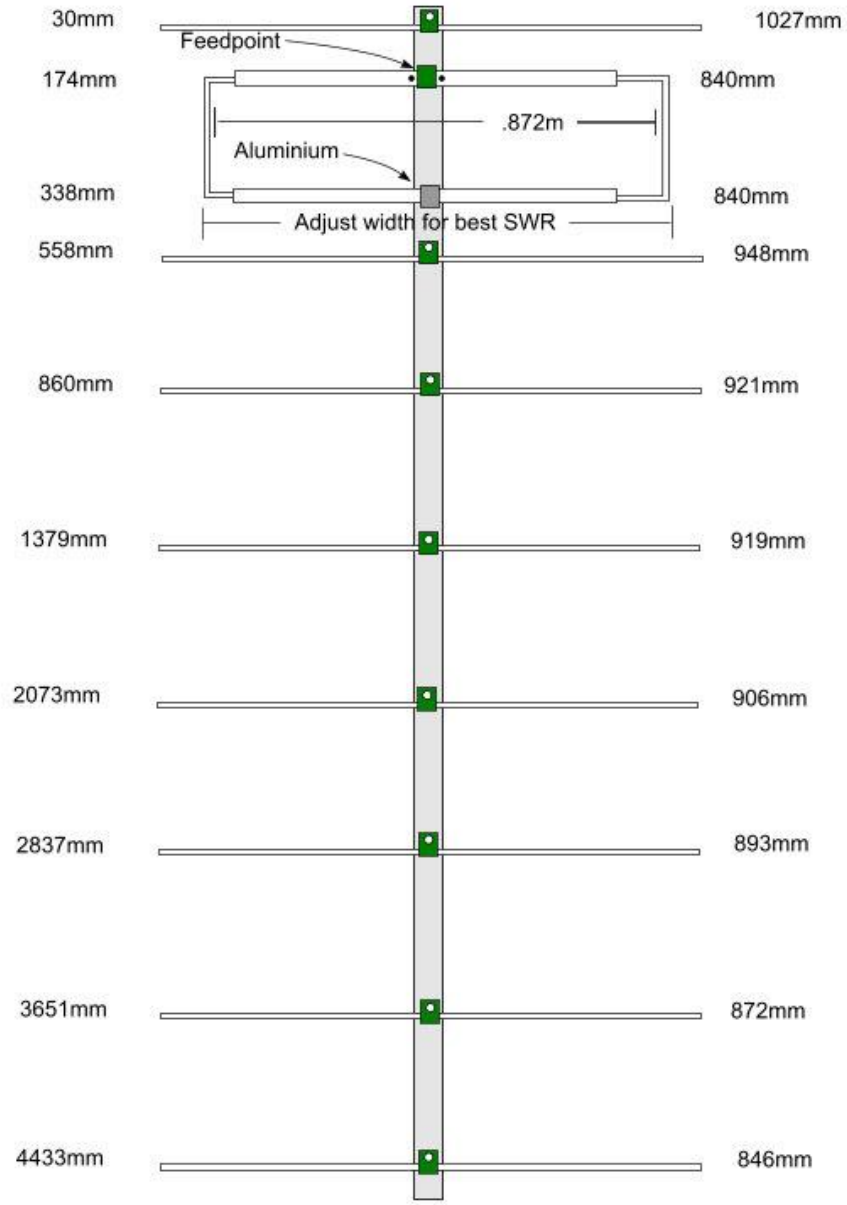
Specifications

Gain @ 144.300MHz:		**14.06dBi**
F/B @ 144.300MHz:		**25.20dB**
Peak Gain:		**14.10dBi**
Peak F/B:		**26.73dB**
SWR Bandwidth:		**1.1:1 from 143.60 – 145.20MHz**
Physical Boom Length:		**4.43m**
Stacking Distance Vertically:	**(2.05 – 3.0m)**	**2.899m**
Stacking Distance Horizontally:	**(2.70 – 3.39m)**	**3.208m**

InnovAntennas

144MHz 9el 50 Ohm 4.43m LFA Yagi

(NOT TO SCALE)



Boom Length : 4.43m
1.25 inch boom (one join) 1/4 inch elements
Wind Survival: 110 mph (elements)

Direct 50 ohm feed

LFA Yagi Build Instructions

The LFA Yagi is simple to construct and in some cases, is shipped part-built with all insulators and boom-to-mast bracket already in place on the boom. All that needs to be assembled are the individual elements, construction of the boom sections, placement of the elements into their respective positions on the boom, measurement of the element end sections (loop) and fitting of the feed-line to the antenna.

First of all insert the boom joining round tubes (if removed) into the end of the square boom sections. These have been marked for easy identification and have been drilled while in place on the boom and therefore will match up perfectly. If they do not, check carefully the labeling as it is likely you have the boom-join either the wrong way around or in the wrong section of boom.

The feedpoint section of loop feed tubes should be placed into the insulator closest to the reflector element. Looking carefully at the centre section of each of these elements, you will see a center mark and a mark either side of the centre mark. The two additional marks will be seen either side of the insulators when the element section is exactly centered. When you have the element in position within the insulator, tighten the element insulator down.

Jubilee clips are already in place on the centre element sections and need to be loosened to allow the insertion of the end element sections. The loop end sections are easy to identify and once inserted should be tightened to around **0.872m** from the inside of the loop section one side, to the inside of the loop section on the other side. The loop will need adjusting once the antenna is complete with the above measurement being the starting point.

Once the elements are in place and tightened, install coax onto the feedpoint for final adjustment of the loop section. If the antenna cannot be tested in its final mounting position, the antenna will either need to be at least a ¼ wave above ground or 1 boom length above ground (whichever is the larger of the 2 measurements) or the antenna should be pointed to the sky before attempting to tune.

Depending on the length of the 'tails' you have between your coax cable and antenna feed point, the final position of the loop for best SWR should only be a few mm + - **0.872m**. Details of how to prepare your coax cable feedpoint to provide the best and shortest connection follow later within this tutorial.

Preparing the feed point

The feedpoint of the LFA consists of 2 x M4 terminals and the feed line needs to have 2 terminal connectors soldiered to it in order that they may be connected together. So why is there no N connector between the coax cable and the antenna on the LFA?

There is good reason that no such connector has been placed upon the antenna. Once any connection to an antenna is no longer coaxial, it becomes a part of the radiating element. At VHF frequencies (and even more so at UHF), these 'tails' between coax and intended radiating element can have a marked impact upon the antennas performance. In simulation tests, these tails (and matching units) have cost up to 10dB F/B (Front to Back) and 0.5dB forward gain due to the distortion they can induce. Often the user can be misled by seeing an N type connector as a part of a sealed box around the centre of the driven element. In many cases, this nice-looking box is simply covering the tails which are definitely there and can be doing the above mentioned damage. Often these sealed units have much larger tails inside resulting in much bigger 'unseen' issues with pattern and performance. (A good indicator and demonstrations as to how F/B can be maintained if an antenna if modeled/built right can be seen here: http://www.youtube.com/watch?v=1eE7j0rvFpU)

It is for this reason we have chosen to encourage direct coax connection to the antenna. Our feed points are designed with a small gap in order that any connection lead (once the coax is split) is small and a 'U' shaped arrangement created around the driven element insulator is modeled and (computer) optimized as a part of the antenna. This ensures there are no surprises when the antenna is installed and performance will be very close to our predicted model and hence, ensures excellent performance.

This method of connection also ensures the minimum amount of coax joins are used too and ultimately this leads to less loss. Furthermore, if a coaxial 'tail' were added at the feedpoint with an N connector, allowing your existing coax cable to connect, additional problems could arise. Even the smallest deviation in impedance between the 2 different coax cables can result in an impedance transformation effect. This can have the same impact as placing a matching device within a badly designed antenna; the antenna has to be adjusted 'out-of-tune' in order for a good VSWR to be seen at the shack. This is not a trait of our antennas, this is a very real issue which exists in any antenna system with a coaxial tail (within or near) a feedpoint arranged in this way. We believe you would want the best and most efficient method of feeding you antenna and this is exactly what we have given you.

The above image shows exactly how the coax cable should be prepared and tags soldiered into place. The absolute minimum amount of 'tail' is seen by arranging the feedpoint in this way and when water-proofing and protection is in place, the 2 tab connectors can be stretched tightly across the LFA feedpoint.

The image opposite shows the feedpoint now wrapped within self-amalgamating tape which will water-proof the joint. PVC electrical tape should then be wrapped over the self-amalgamating tape in order to UV-protect the joint and further protect it from the weather.

Rest assured you now have a very tight and well protected feedpoint which will keep your antenna functioning correctly for many years to come. You have no 'water-proof' box to hold moisture and damp, no overly-long tails to de-tune your antenna and no unnecessary joins or connections within your coax cable, perhaps even just one single piece of coax cable connecting your transceiver to the antenna.

Before fitting the coax to the antenna, we now need to wind a choke balun to ensure stray currents do not flow back along the outer braid of the coax cable and radiate. The best and easiest way to achieve this is to wind the coax around a house-hold can but first, placing some cable ties upon the can to allow for the choke to be held in place, once sufficient **(3) turns** have been wound. See the photo below on how best to conduct this process.

Once you have the desired number of turns on the can, join the end sections of the cable ties and pull them tight in order the choke is firm and will not go out of shape or remove itself from the loop.

Now slide the can out of the loop and you should have a perfectly formed choke (although you may now need to tighten the cable ties once more).

It is a good idea to have one less turn than required while the can is in place. This will allow you sufficient room to mount the coax cable (and choke) onto the feedpoint of the antenna and then manually wind the final turn by hand, ensuring the shortest possible run of coax between the feedpoint and where the first turn of the choke starts.

It is also a good idea to use a sealant of some kind upon the antenna terminals in order to avoid water ingress. Some clear (good quality) bathroom sealant will also do an excellent job. However, the best rubberized sealants come out of the aerospace industry. They paint on and solidify into a hard rubber. If your installation is going to be long-term then this method of sealing is worth considering. http://www.silmid.com/Products/Sealants/PPG-Aerospace-Sealants.aspx

LFA Installation and fine-tuning

The LFA Yagi is modeled and manufactured to very fine tolerances and therefore, needs very little adjustment. Only the loop width will need to be altered and adjusted for the best (lowest) VSWR. As with any Yagi, fine-tuning should be conducted at least ¼ wave or one boom length (whichever is the longest measurement) above ground, otherwise false results may occur. If you simply do not have the means to test and setup the antenna at the above suggested height, then the antenna should be pointed upwards to the sky at the highest angle possible in order to make loop adjustments.

When coming close to expected VSWR, very small adjustments will be needed and it is suggested that adjustments of no more than 1mm (each adjustment) should be made each time.

If your antenna does not tune as expected, take a look around you and see if there is anything close by that may have an impact. In addition, metal buildings or outhouses, wires overhead or other antennas nearby may also have an effect. If the antenna is not being tuned on the ground but in the position it will be installed, again look around for nearby objects and report these anomalies and send a photo of your installation to support@innovantennas.com for diagnosis.

Weather proofing

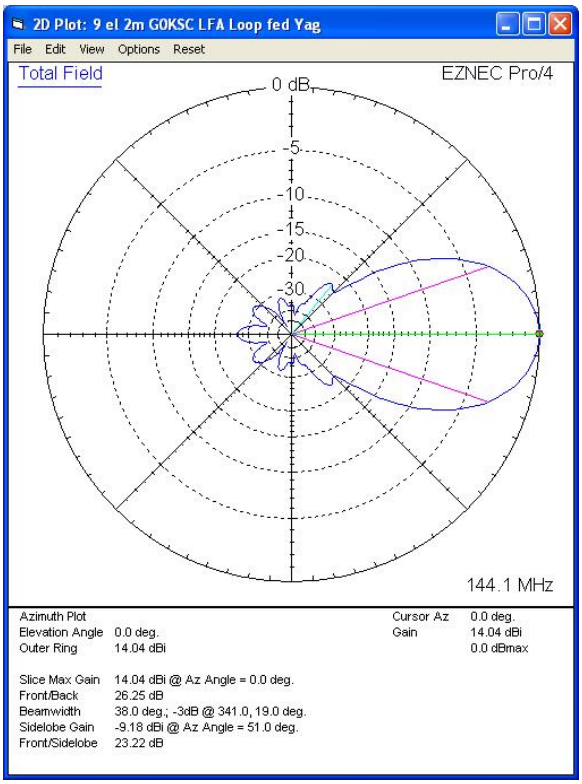
Your antenna is designed and built with quality components which will ensure long-life and excellent performance for many years. However, to extend the life of your antenna or when the antenna is installed near salt water then additional care and preparation should be taken during construction.

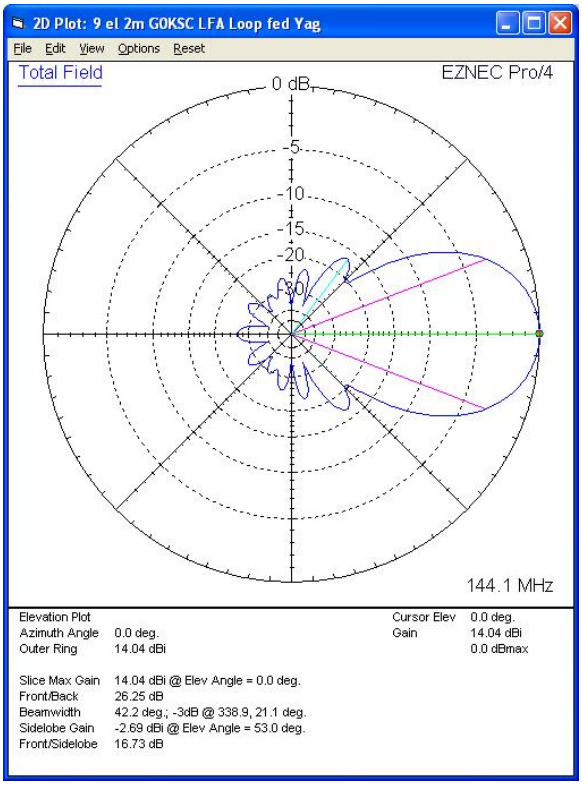
Best long-term results in the above such conditions would be seen from a 'spot-weld' at element joins and junctions. As this is not practical in most cases, other precautions should be taken. One excellent method of sealing is discussed above and uses an aerospace sealant at the joins.

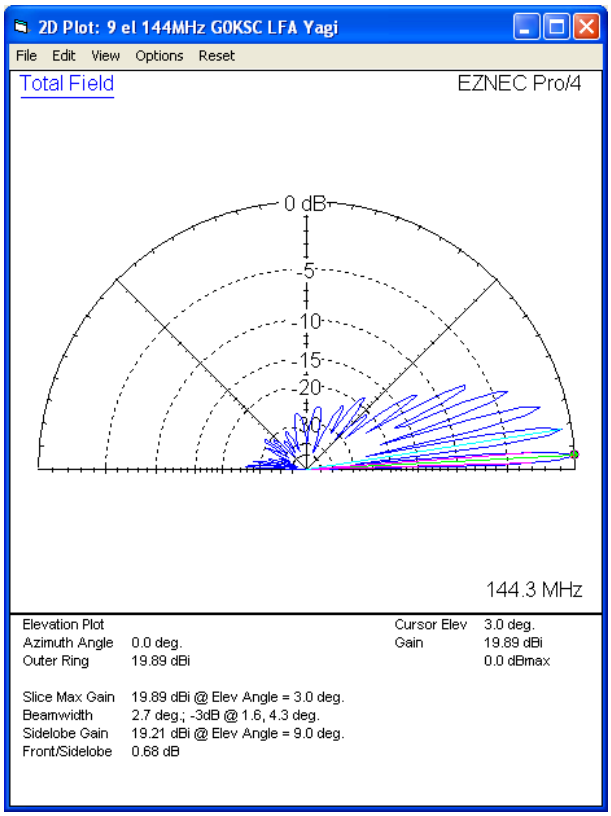
It is important to note that insulation tapes (and similar) are not a good idea to add at junctions. They retain any moisture which can enhance corrosion and accelerate deterioration. As a worst case scenario, level the connections 'open' if installed within a harsh environment (such as close to the sea) dismantle every few years or so and clean the aluminum at the joins.

This said, InnovAntennas allow for large join-section overlapping and as a result, any induced resistance will be small. However, we believe it is best to discuss and present possible further requirements in order you can manage your installation accordingly.

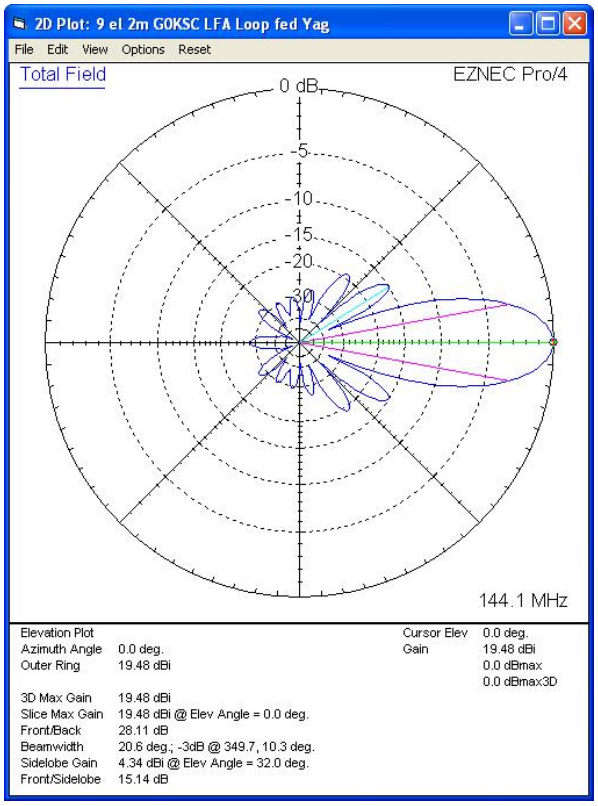
Azimuth, Elevation and SWR Plots

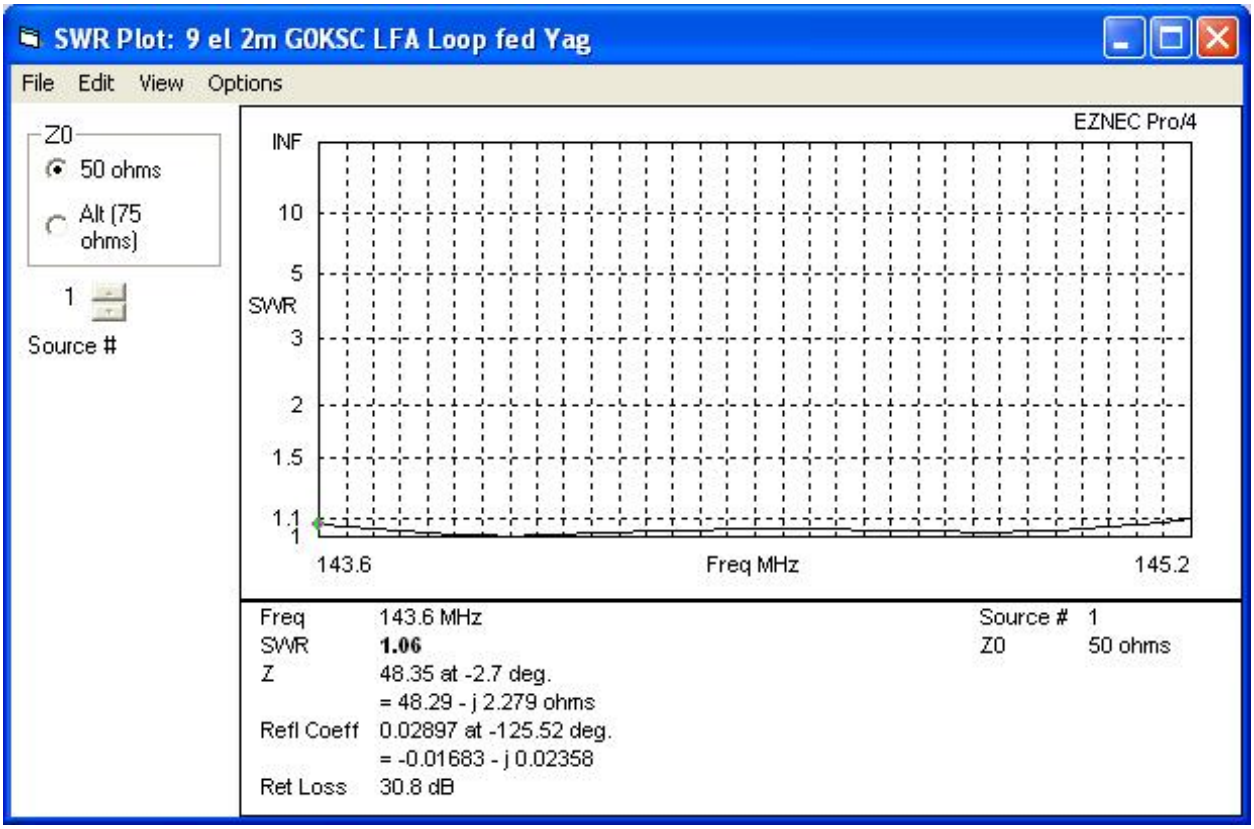






10m above ground





SWR Plot

Antenna Build Notes