

Enhancing the Stacked Yagi with the Addition of Z Axis Parasitic Elements

by Justin Johnson, G0KSC

Within this article, we will look at the positive impact additional parasitic elements can add to a stack of Yagis, both mono and multi-band, the optimisation routes to take and how I came to experiment in this area in the first place. Within this discussion, HF Yagi stacks will be covered briefly. There is good reason for this as this will help the reader understand how this experimentation in VHF came to be.

Several years ago, I moved from VHF/UHF to HF Yagi design for commercial reasons. One of the big markets in this area is the multiband, single feed point Yagi and this led to the development of my XR6, a 3.5m long HF Yagi covering 20m to 6m. One of the questions that became common from customers of this very popular Yagi was 'What is the recommended stacking distance?'

To me this was a nonsense question, a multiband Yagi is always going to be a compromise over a monoband Yagi and so too would any stacking distances; what would be ideal on one band would be a compromise on the others. However, this was a difficult to accept for most customers who pointed out that other companies provide a recommended stacking distance for their equivalent designs, despite the fact I had explained fully the associated issues which would remain with any similar design.

This started me thinking outside of the box and experimenting with the stacking distances for 2 or more of these multiband Yagis and establish exactly what the pro's and cons would be.

One of the requirements I had was to provide the ideal stacking distance for my new XR3-NV, tri-bander with a 9m boom. In most instances, a stack like this would be positioned at the ideal distances for 15m, with 10m over-stacked and 20m under-staked. The 'ideal' would be to stack at the ideal 20m stacking point with 15m and 10m benefiting from more gain due to the wider spacing. However, there are two by-products of doing this. The first being large, high-angle forward-facing lobes in the elevation plane (which apparently is not considered an issue with HF contesters) and the second being loss of Front to Back Ratio (F/B); in most cases, serve over-stacking results in almost rotating dipole style performance.

Added more Yagis closer together does not work, we have seen this in experiments in the past with very little benefit in terms of gain being seen and often, F/B is still negatively impacted. My first idea was to remove the 20m elements from the XR3-NV and re-optimize the 15m and 10m elements in order there was a form of hybrid 2 band Yagi between the tri-banders but to my surprise, the 15m and 10m performance did not get better with the patterns clearly still reacting as though severely under-stacked. How about just early elements, reflectors as a start?

This addition made a huge impact. Not only was I able to achieve decent levels of F/B in the 2 sub bands (15/10), but performance (when optimised) is increased by more than their theoretical maximum of 3dB for a stacked pair. This result also meant that the 20m spacing no longer needed to be at minimum levels but closer to the ideal spacing for the 20m section with an increase being seen in gain on the sub bands.

After many hours of experimenting, I was able to establish enhancements could also be achieved from the addition of a 'dummy' driven element or first directors in the sub array too although this was heavily dependent on the extent of the over-stack of the array in question. Fig. 1 shows an EZNEC layout of the elements of 2 x XR3-NV's with a single sub-array placed between them.

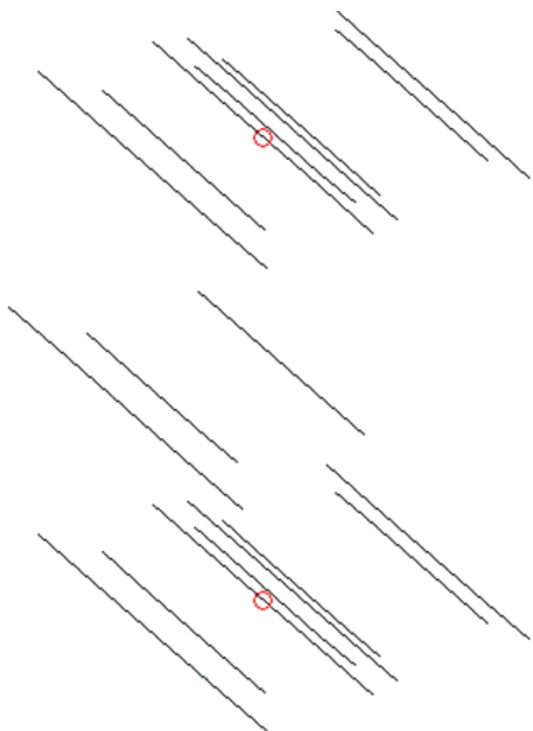


Fig. 1: 2 x tri-band XR3-NV's with sub-array providing performance enhancements on 15m/10m

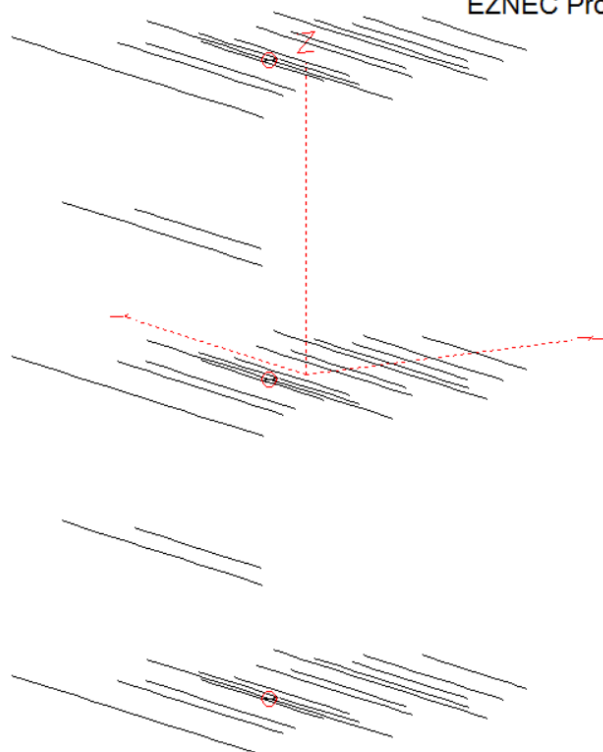


Fig. 2: 3 stack of InnovAntennas / G0KSC XR3NV Tri-band Yagi with Sub Reflector Arrays

In the line-diagram of element layout in Fig. 1, the sub array can be seen to have a single reflector for the 15m band and a reflector and additional director for the 10m band and this combination produced the best results at the spacing needed with these 2 x XR3-NVs for this customer.

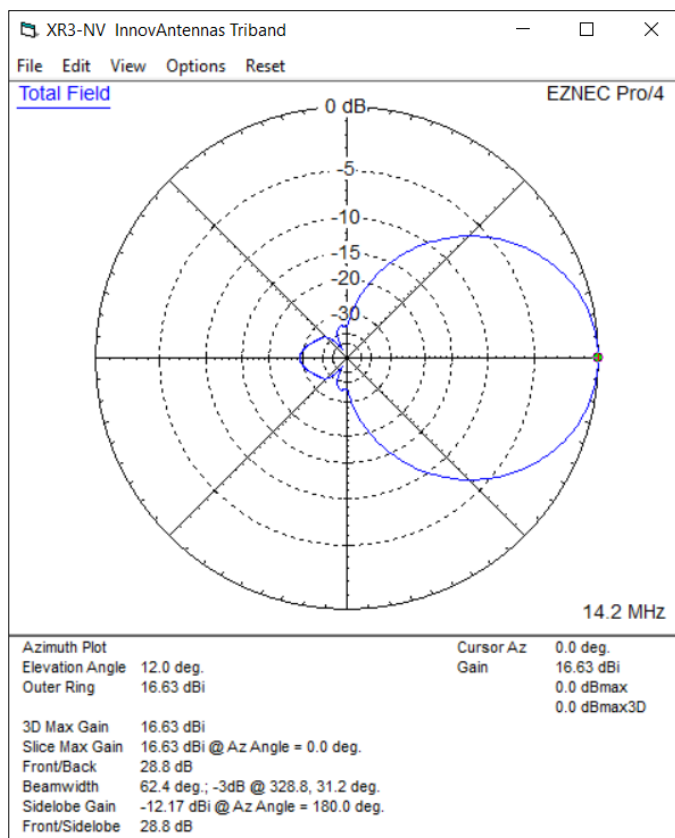


Fig. 3: 20m stack results with no sub array enhancement needed

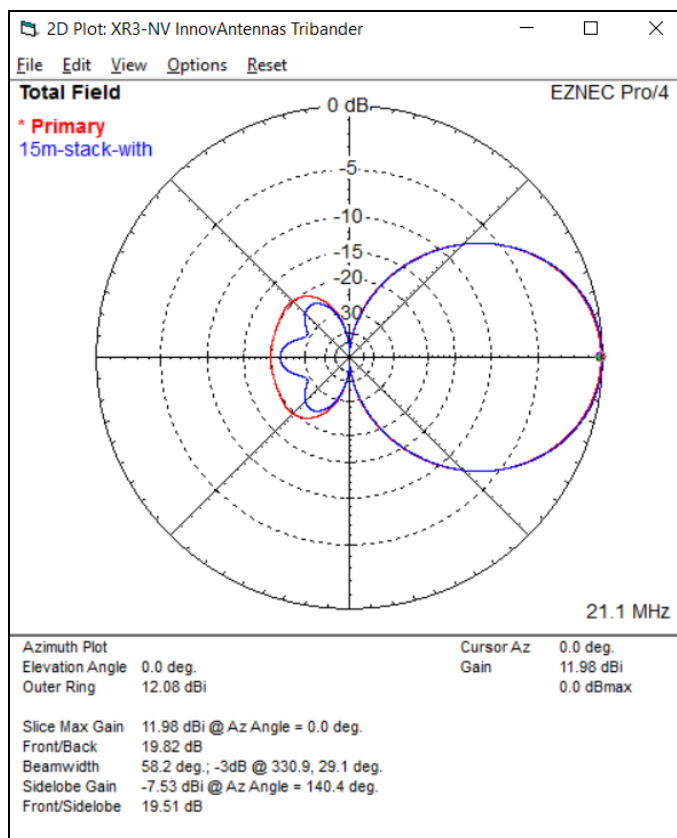


Fig. 4: 15m stack results with Sub Array of 2 x 15m optimised reflectors (blue) without (red)

The FULL article was published in DUBUS Magazin 2/2017.
More information and content lists for the magazines and books are on

www.DUBUS.org

DUBUS ORDER FORM

..... x	<u>TECHNIK 6</u>	book - Buch	EUR 25,- / USD 35,-	=	.....	EUR/USD
..... x	<u>TECHNIK 7</u>	book - Buch	EUR 25,- / USD 35,-	=	.....	EUR/USD
..... x	<u>TECHNIK 9</u>	book - Buch	EUR 25,- / USD 35,-	=	.....	EUR/USD
..... x	<u>TECHNIK 10</u>	book - Buch	EUR 25,- / USD 35,-	=	.....	EUR/USD
..... x	<u>TECHNIK 11</u>	book - Buch	EUR 25,- / USD 35,-	=	.....	EUR/USD
..... x	<u>TECHNIK 12</u>	book - Buch	EUR 25,- / USD 35,-	=	.....	EUR/USD
..... x	<u>TECHNIK 13</u>	book - Buch	EUR 25,- / USD 35,-	=	.....	EUR/USD
..... x	<u>TECHNIK 14</u>	book - Buch	EUR 25,- / USD 35,-	=	.....	EUR/USD
..... x	<u>TECHNIK 15</u>	book - Buch	EUR 25,- / USD 35,-	=	.....	EUR/USD

All items include free shipment!

.... x	<u>DUBUS 2011</u>	complete set (Jahrgang)	EUR 25,-/USD 35,-	=	....	EUR/\$
.... x	<u>DUBUS 2012</u>	complete set (Jahrgang)	EUR 25,-/USD 35,-	=	....	EUR/\$
.... x	<u>DUBUS 2013</u>	complete set (Jahrgang)	EUR 25,-/USD 35,-	=	....	EUR/\$
.... x	<u>DUBUS 2014</u>	complete set (Jahrgang)	EUR 25,-/USD 35,-	=	....	EUR/\$
.... x	<u>DUBUS 2015</u>	complete set (Jahrgang)	EUR 25,-/USD 35,-	=	....	EUR/\$
.... x	<u>DUBUS 2016</u>	complete set (Jahrgang)	EUR 25,-/USD 35,-	=	....	EUR/\$

.... x	<u>DUBUS 2017</u>	Abo / Subscription DL / EU:	EUR 28,-	=	....	EUR
.... x	<u>DUBUS 2017</u>	Subscription: <u>Outside EU</u> :	EUR 30,-/\$40,-	=	....	EUR/\$

.... x	<u>DUBUS 2018</u>	Abo / Subscription DL / EU:	EUR 28,-	=	....	EUR
.... x	<u>DUBUS 2018</u>	Subscription: <u>Outside EU</u> :	EUR 30,-/\$40,-	=	....	EUR/\$

Gesamtsumme / Total Amount : EURO / USD

Please make bank transfer or **PAYPAL**
payment to **DUBUS@t-online.de** (Sorry, NO creditcards, NO cheques!)

Name:

Call:

Street/Str.:

ZIP/Town – PLZ/Ort:

-> If you transfer to our bank account, please transfer to: Verlag Joachim Kraft,
Account-No: IBAN DE92200100200207354201 - BIC PBNKDEFF
DUBUS, Grützmühlenweg 23, D-22339 Hamburg, Germany

© **DUBUS Magazine** – **www.DUBUS.org**