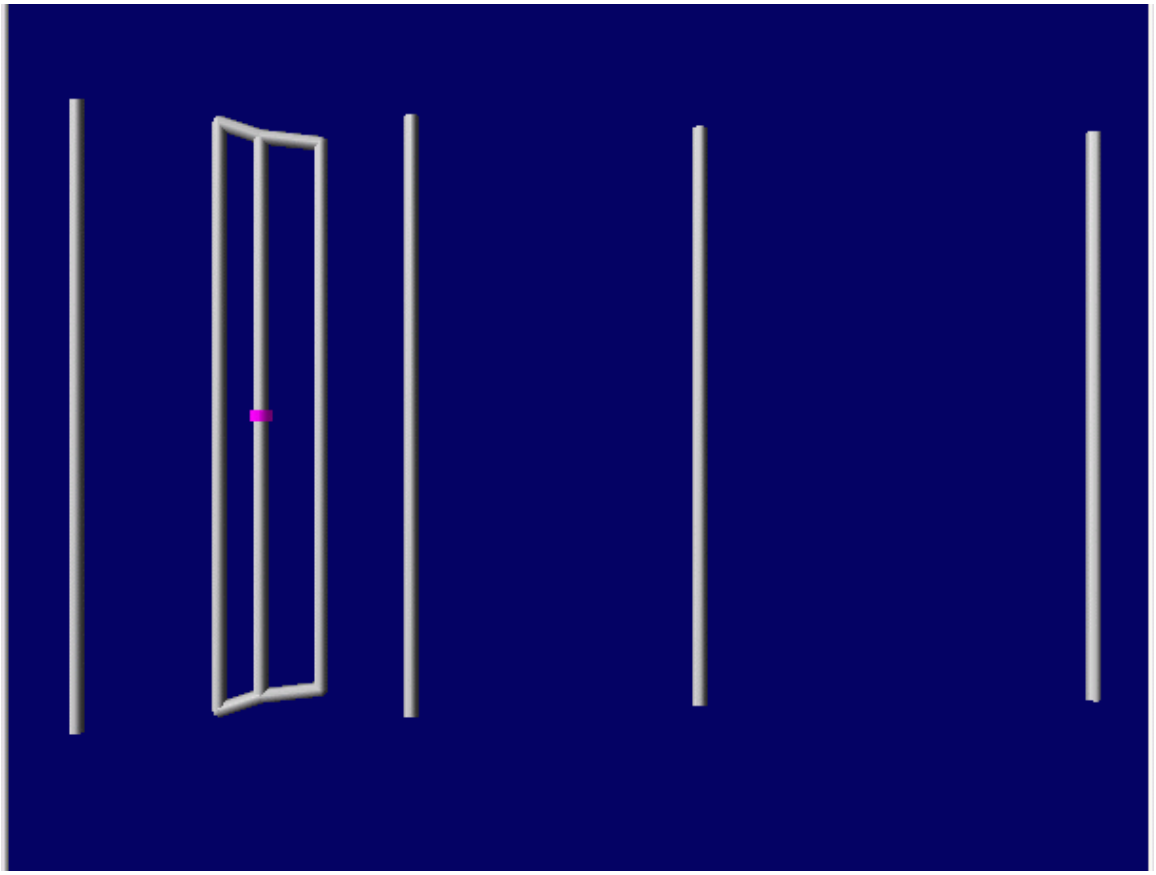


Triple Folded Dipole Feed for Yagi Antennas

Dragoslav Dobričić, YU1AW

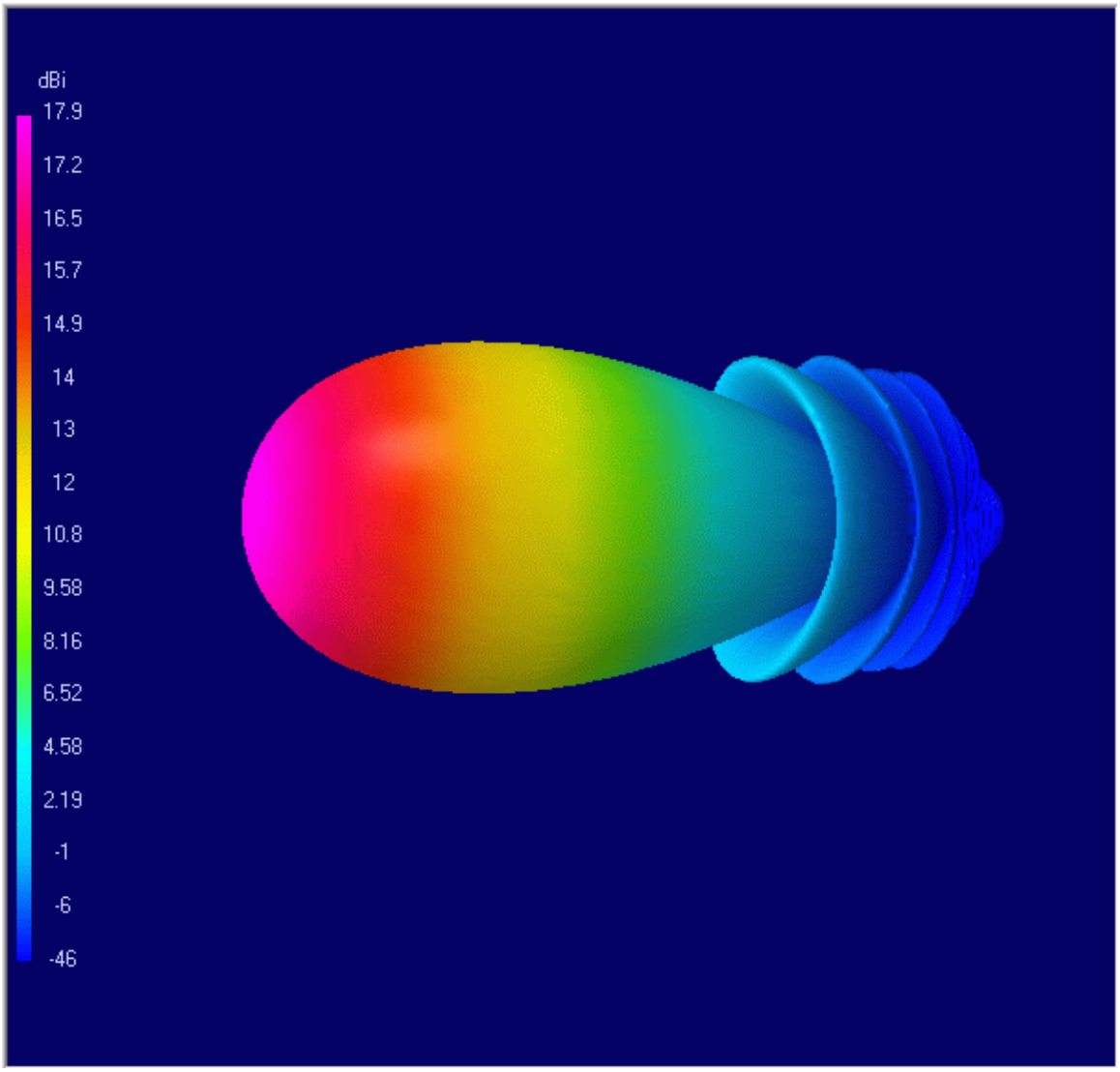
Introduction

In referenced article **[1]** G0KSC published his 'Revolutionary Loop Feed Array Yagi Antenna Feed System'. Reading this article I concluded that the idea is good but that it would be possible to get much better results with even further modified Yagi antenna feeding system.

It is known that for the best cancellation of antenna rear lobes in order to get as clean pattern as possible it is necessary to separately and precisely tune currents amplitude and phase in passive elements which are immediate to driver, i.e. reflector and first director. This would be possible by optimum tuning of coupling by varying distance and phasing by varying length of driven element almost independently for each nearest passive element reflector and first director. Optimum coupling and phasing can be done only if driven element is mechanically designed in such way that enables almost independently and simultaneously tuning for best distance and length according to demands on both nearest passive elements. Triple Folded Dipole Feed (3FDF) System, situated in the plane of an antenna, gives this opportunity.

3FDF is constructed in such way that each of three dipoles fulfills one of demands. A dipole nearest to the reflector serves as system for coupling and tuning of mutual impedance between driver and reflector. The dipole nearest to first director does the same thing for the driver and

first director. Third, the middle dipole is fed by coaxial cable and can be used for changes of antenna impedance transformation ratio. Such construction of driver element gives opportunity for very flexible and almost independent tuning of currents in adjacent elements.



3D pattern of 3FDF fed Yagi antenna

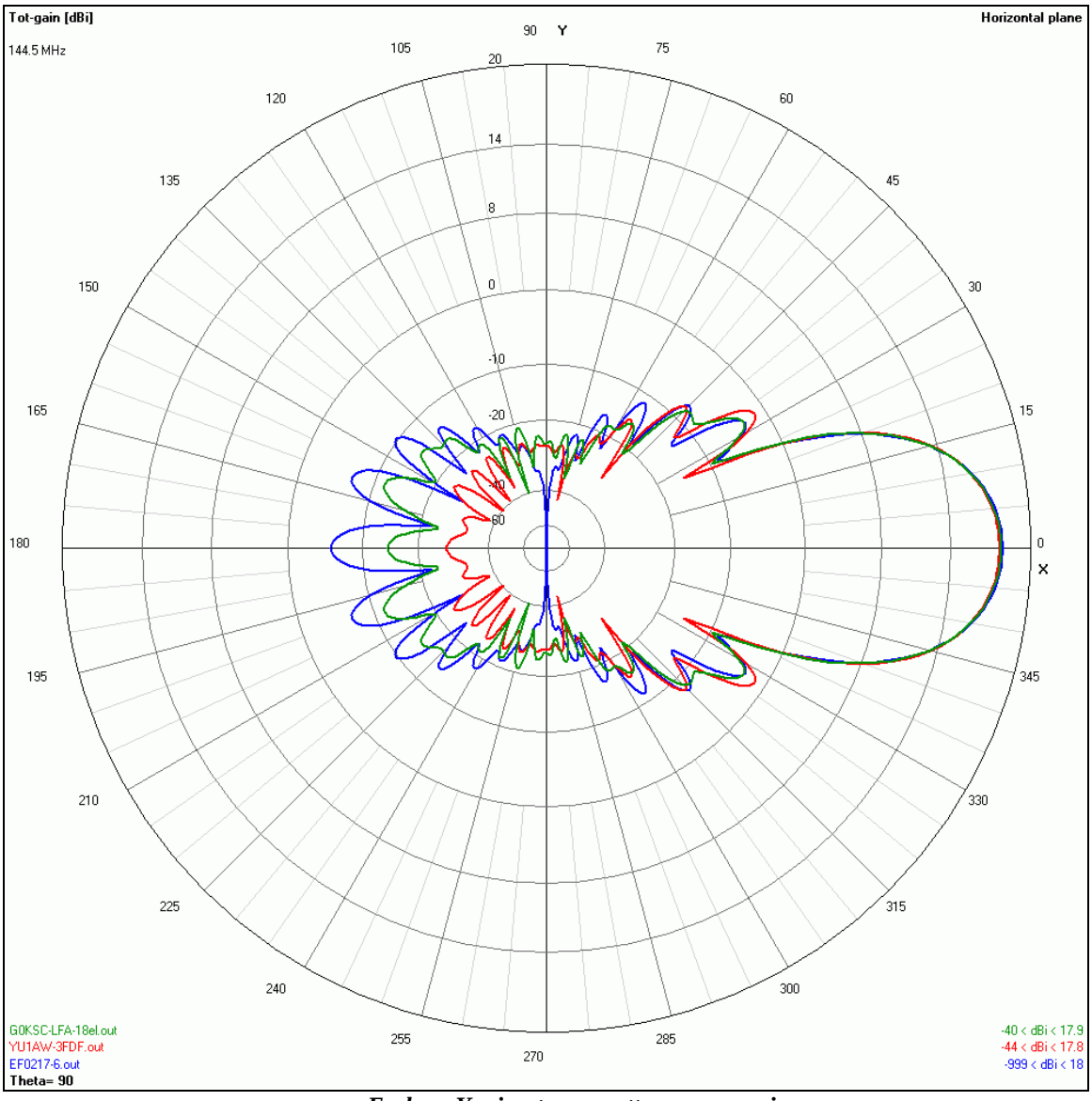
Obtained results

After relatively short period of simulations and playing with driven element design it was shown that my hypothesis were correct. Very good cancellation of all side lobes situated in the back hemisphere of the antenna spatial pattern shows that the new driver element works just as expected.

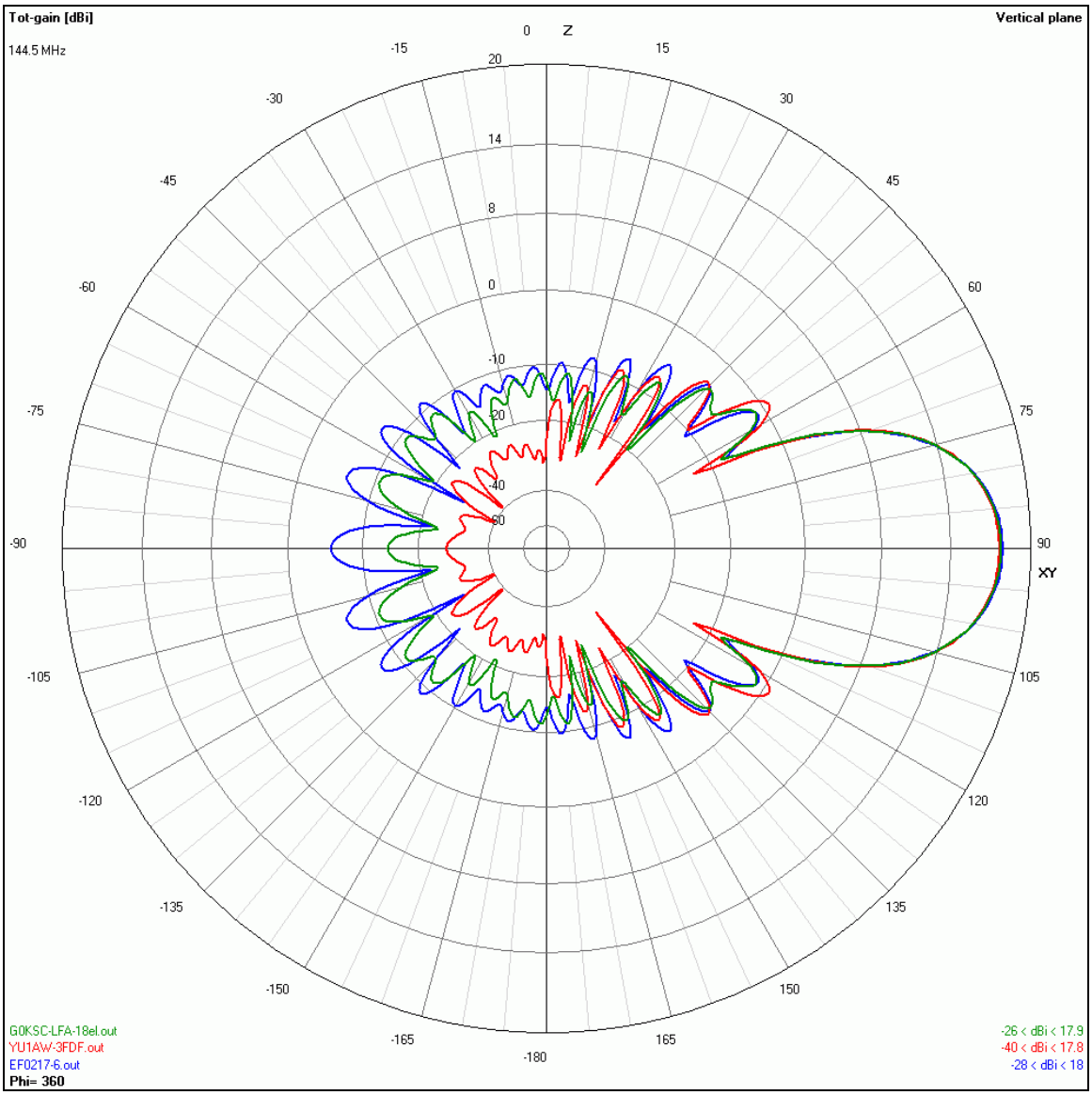
LFA 18 el. antenna published on G0KSC web site **[3]** is used for feed modification and also as a reference antenna for comparisons.

YU7EF 17 el. Yagi antenna with classic open half wave dipole is also simulated and compared with LFA and 3FDF antennas.

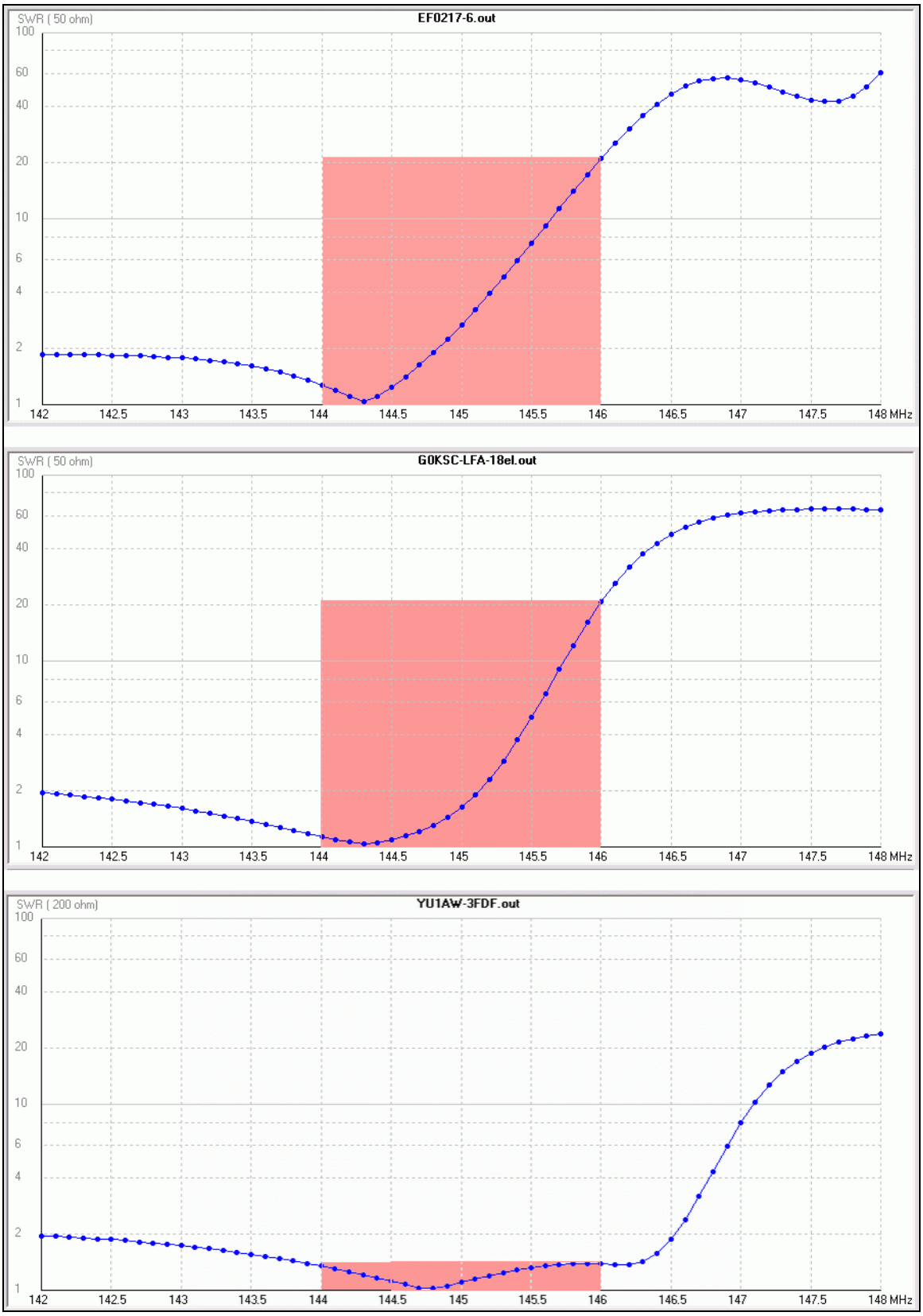
Comparisons of antenna patterns, SWR, wide band gain and Q factors for these three antennas are given on figures.



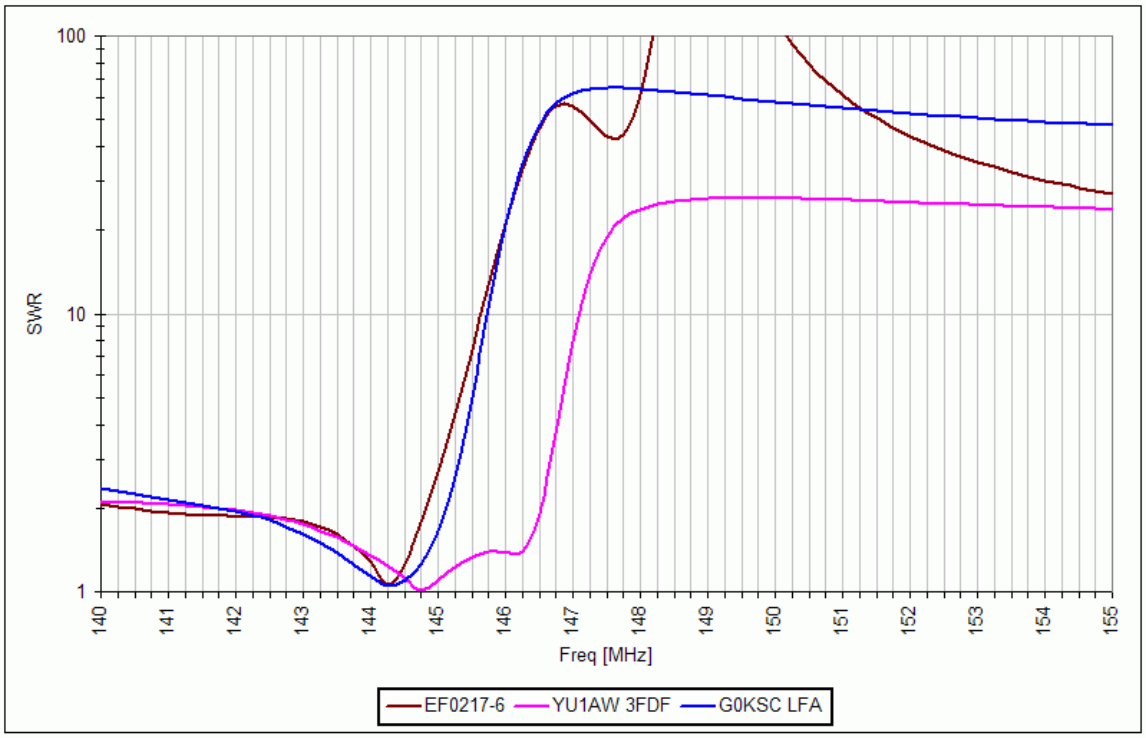
E-plane Yagi antenna patterns comparison



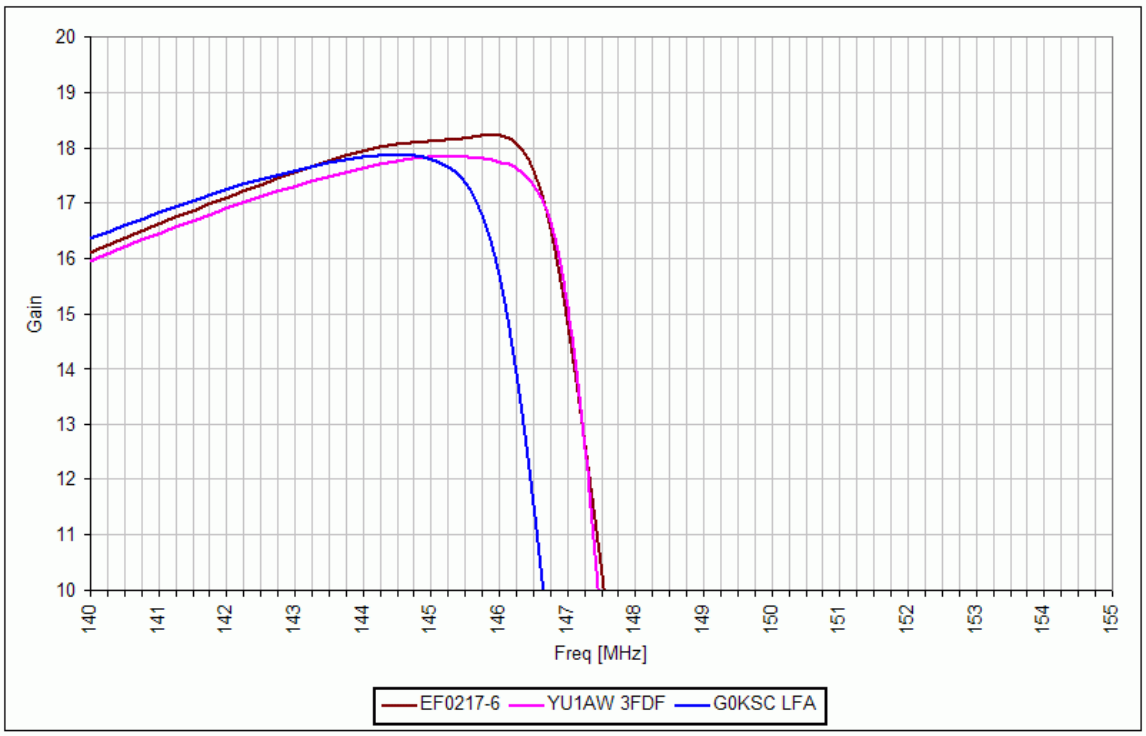
H-plane Yagi antenna patterns comparison



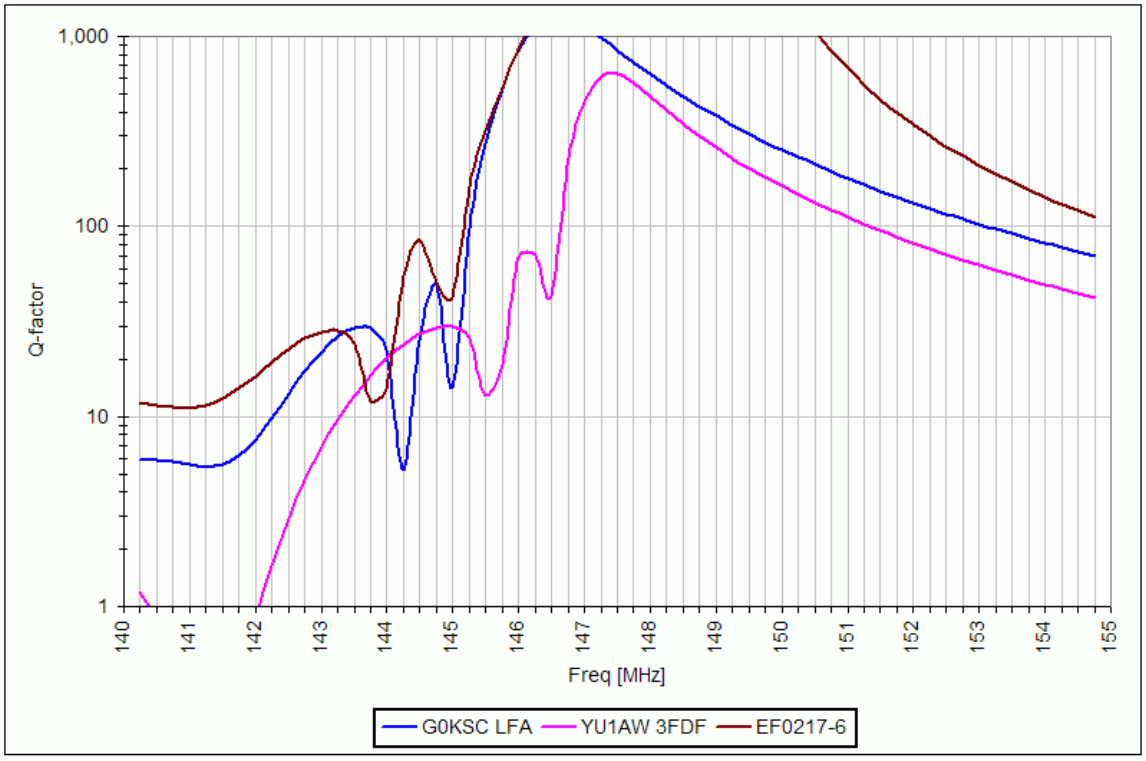
Yagi antennas SWR within amateur band comparison



Yagi antennas SWR in broader band comparison



Yagi antennas broadband gain comparison



Yagi antennas Q factor comparison

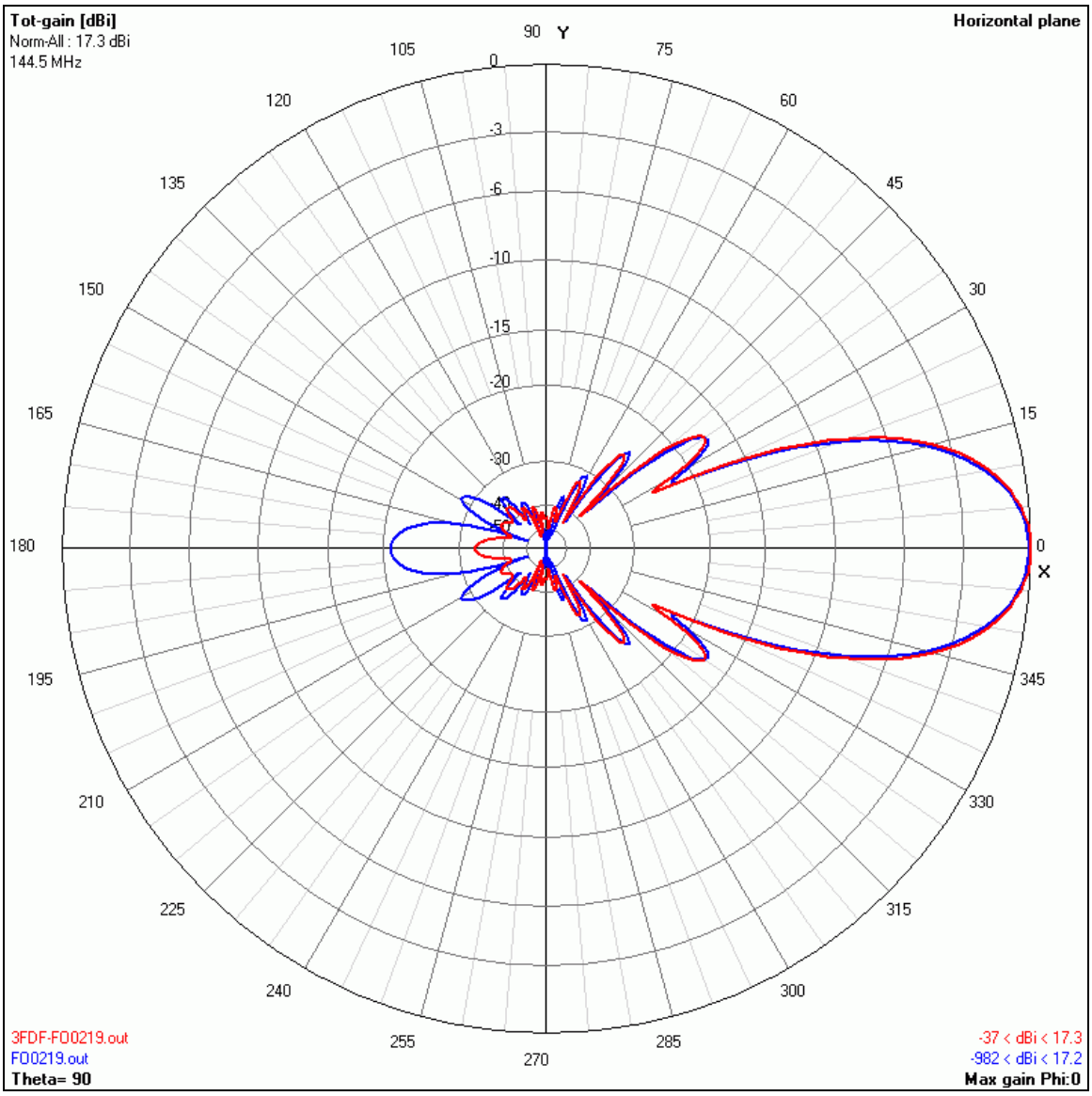
As can be seen on the diagrams, average Q factor **[2]** of 3FDF fed antenna within the amateur band 144-146 MHz is lower and SWR working bandwidth much wider than for both other antennas.

3FDF fed antenna diagrams in both planes have much better suppressed rear side lobes. First side lobes are 1-2 dB less suppressed than for other two antennas. Partially, this is due to forcing optimizer to lower Q factor of antenna.

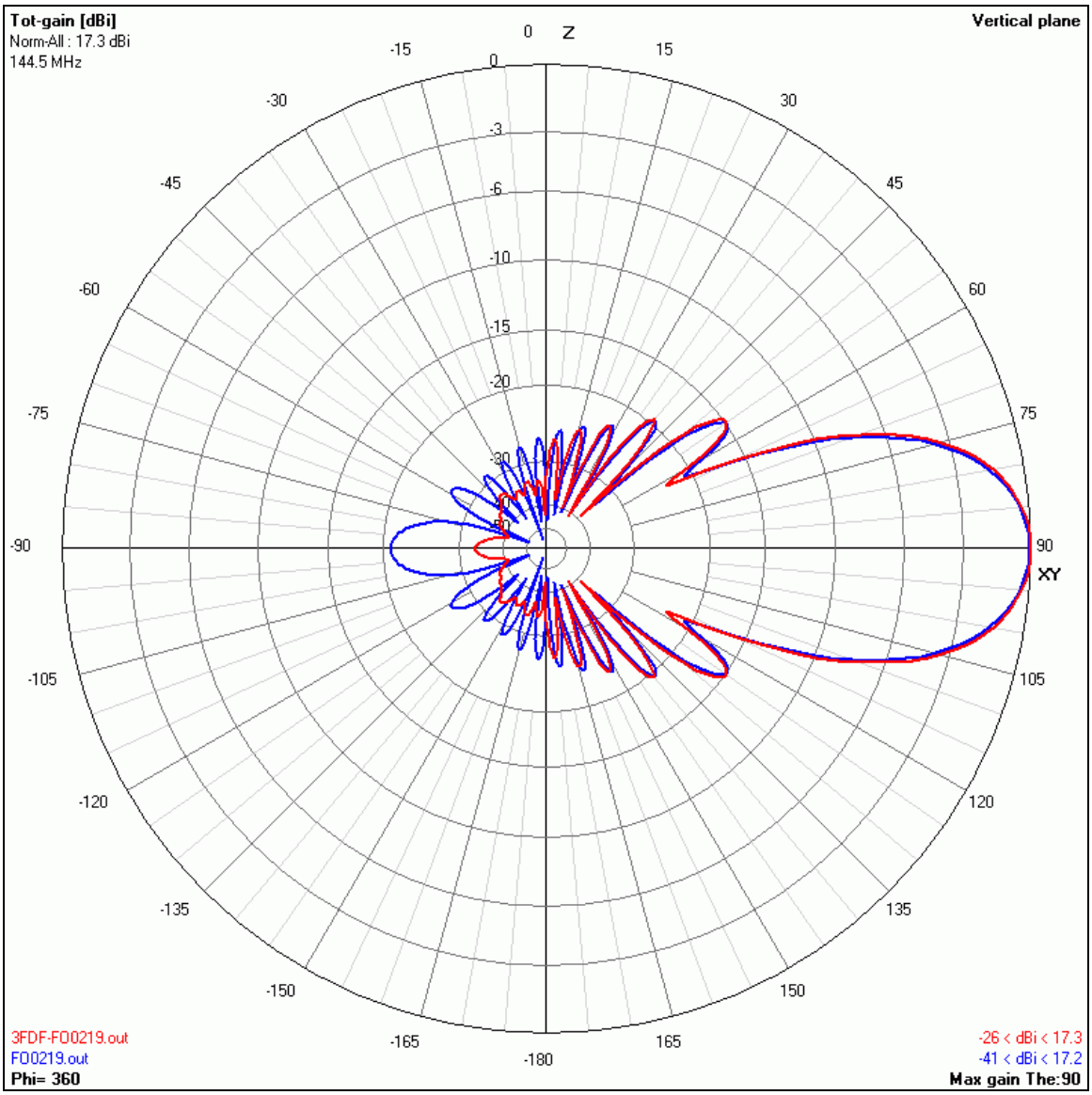
Another very interesting property of 3FDF feeding system is the possibility to improve rear lobe suppression of some popular antenna by using 3FDF driver and small rearrangements of elements distances in order to accommodate the new feed system.

A most interesting thing is that front hemisphere of the antenna's spatial diagram is left unmodified and only side lobes in the rear hemisphere are better suppressed due to better phase cancellation. It clearly shows effects of an optimum reflector and first director phasing principle which is obtained with this new type of Yagi antenna driver.

As an example, I used K1FO 19 el. Yagi antenna and modified it by replacing the original feed system with 3FDF driver. After a small rearranging and short optimization of element positions I got diagrams as follows.

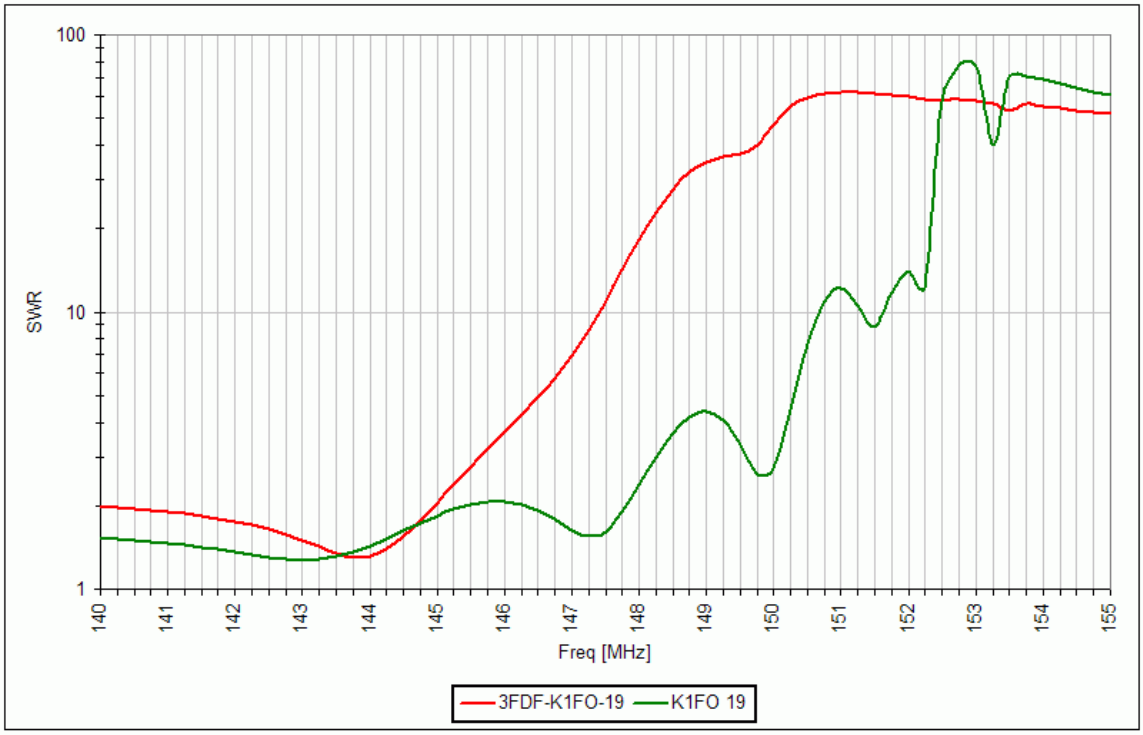


Original and 3FDF modified K1FO 19 el. Yagi antenna E-plane patterns comparison

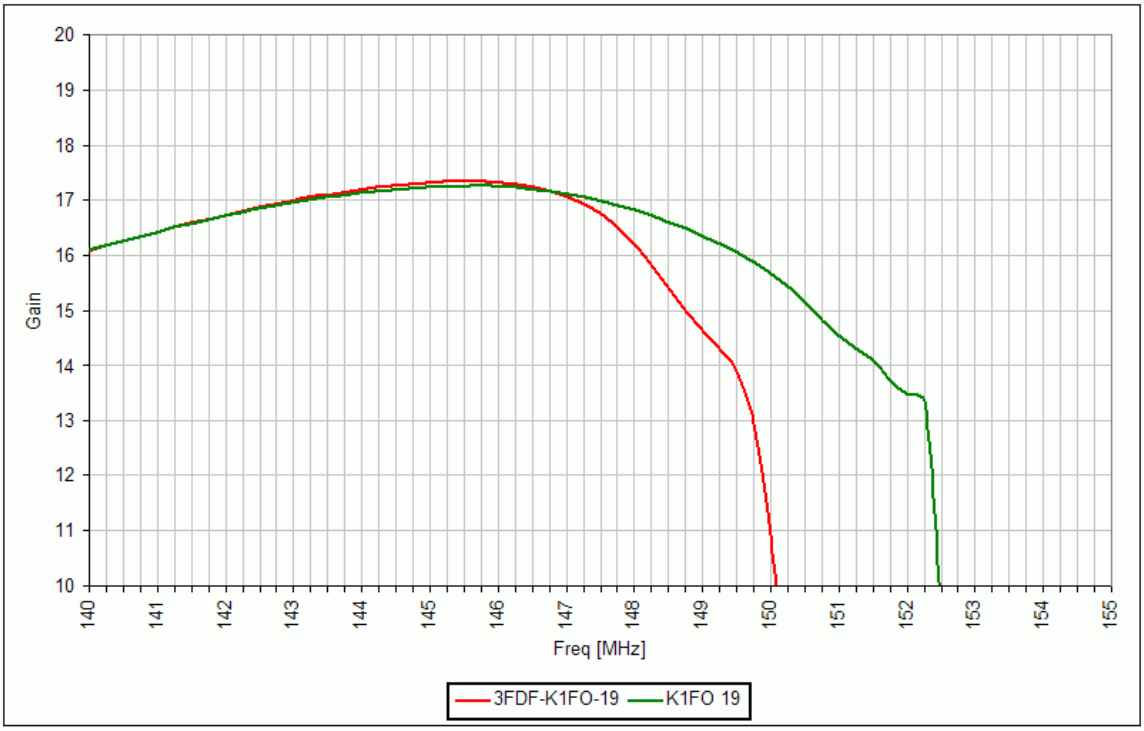


Original and 3FDF modified K1FO 19 el. Yagi antenna H-plane patterns comparison

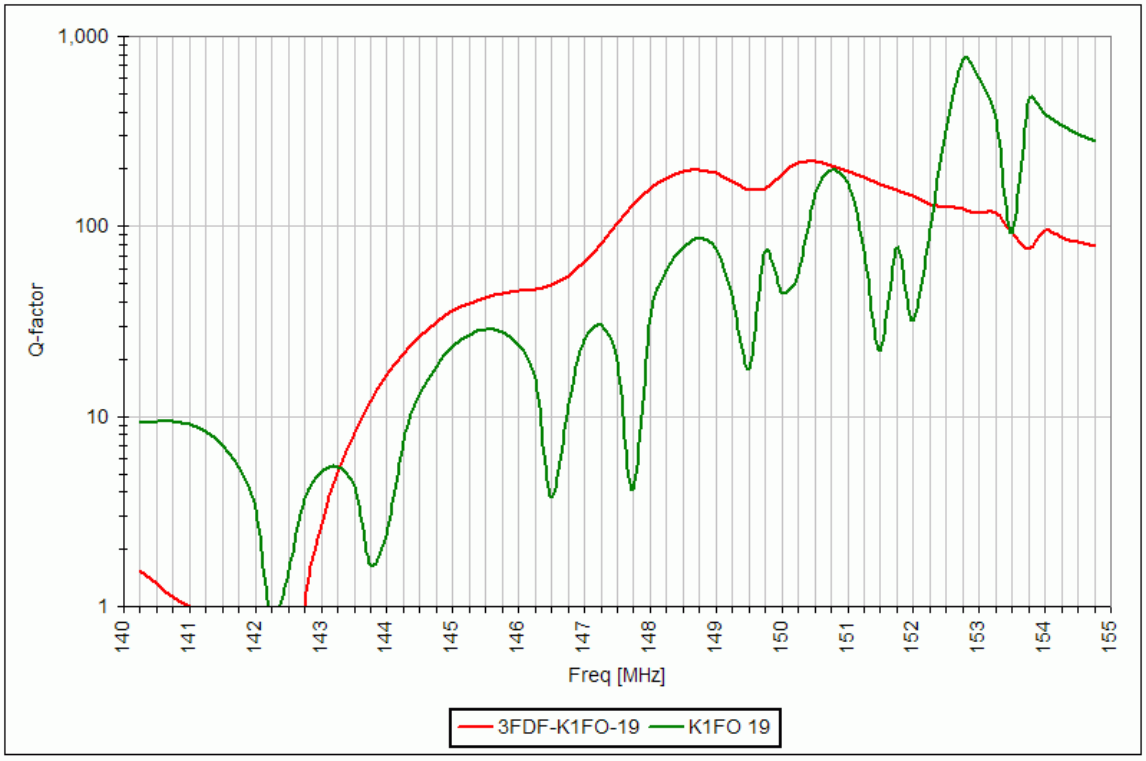
As can be seen, the front parts of the diagrams in both planes stay unchanged but the rear part is considerably changed. SWR working bandwidth, Q factor and wideband gain are also changed and comparison of modified and unmodified antenna is given on the Figures.



Original and 3FDF modified K1FO 19 el. Yagi antenna SWR comparison



Original and 3FDF modified K1FO 19 el. Yagi antenna wideband gain comparison



Original and 3FDF modified K1FO 19 el. Yagi antenna Q factor comparison

Conclusion

In this paper I presented a new type of Yagi antenna feeding system which is consisted of triple folded dipole driver (3FDF). As it is expected, the input impedance in this new antenna is 200 ohms and can be easily fed by a simple half wave 1:4 BalUn.

As explained before, the new driver gives opportunity of better currents magnitude and phase control in reflector and first director elements and thus provides better antenna pattern rear and side lobe cancelations. This is also confirmed by using the new 3FDF driver in some old but good Yagi antennas where it shows the same effects on rear lobe suppression. **-30-**

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1. Justin Johnson G0KSC, **Revolutionary 'Loop Fed Array' Yagi Antenna Feed System**, DUBUS Magazine, vol.38, 2/2009, Pages 82-92.
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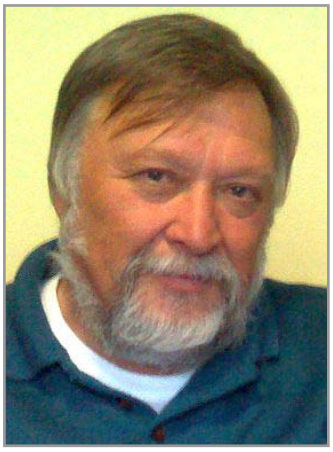

Dragoslav Dobričić, YU1AW, is a retired electronic Engineer and worked for 40 years in Radio Television Belgrade on installing, maintaining and servicing radio and television transmitters, microwave links, TV and FM repeaters and antennas. At the end of his career, he mostly worked on various projects for power amplifiers, RF filters and multiplexers, communications systems and VHF and UHF antennas.

For over 40 years, Dragan has published articles with different original constructions of power amplifiers, low noise preamplifiers, antennas for HF, VHF, UHF and SHF bands. He has been a licensed Ham radio since 1964. He is married with two grown up children, a son and a daughter.

antenneX Online Issue No. 147 — July 2009
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