Inverted Amos Sector Antenna for 2.4 GHz WiFi

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Introduction

In my previous article Amos antenna **[1]** I described how it is possible to build WLAN antenna with semicircular horizontal diagram of radiation using Franklin's antenna in front of a narrow reflector surface. In that article I described how it is possible to decrease, or almost completely eliminate, undesired radiation of the short circuit at the end of phasing lines in order to get a clean pattern unspoiled with these parasitic radiations. By placing the reflector near the short circuited end of the two wire line, it was achieved that the wire that short circuited the two wire lines acts with the close reflector as a transmission line, with an impedance of about 150 Ohms. In that way, its parasitic radiation is considerably reduced. In addition, it was possible to increase the length of that wire to achieve the desired distance between wires and needed value of characteristic impedance of two-wire line.

The gain of Amos antenna is dependent on the vertical diagram radiation angle, i.e., the number of vertically stacked dipoles. Increasing the number of dipoles in Amos antenna increases gain, but it leads to saturation due to progressively less and less current in new added dipoles, and after about 9 dipoles, the increase of gain by increasing of dipole numbers, becomes non-economical. In **Fig. 1** and **2**, comparative diagrams of Amos antenna with different number of dipoles: 3, 5, 7 and 9 are shown.

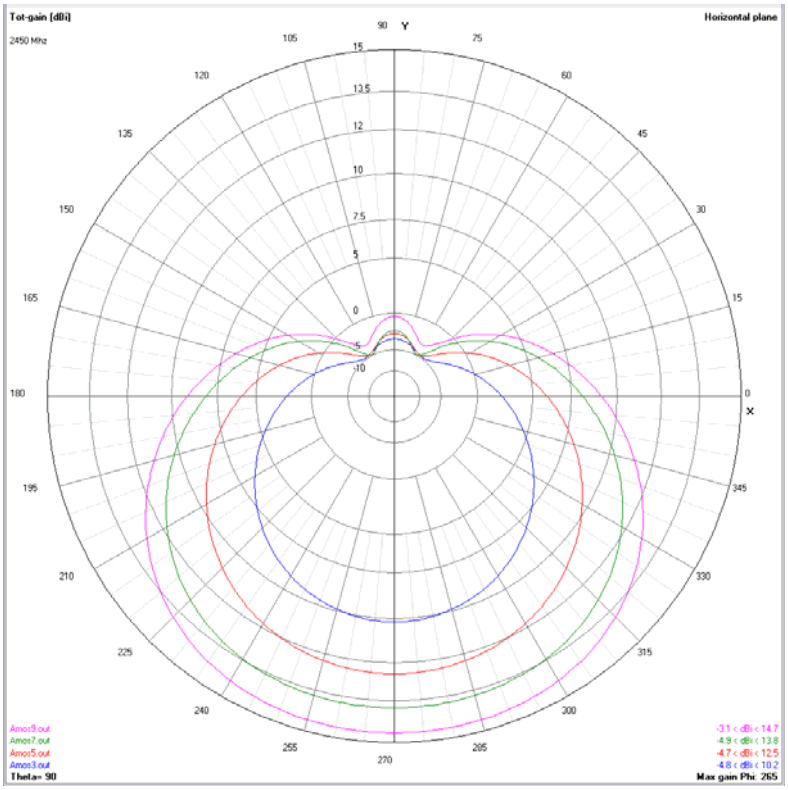

Fig. 1. Horizontal radiation diagram of Amos antenna with different number of 3, 5, 7, and 9 dipoles.

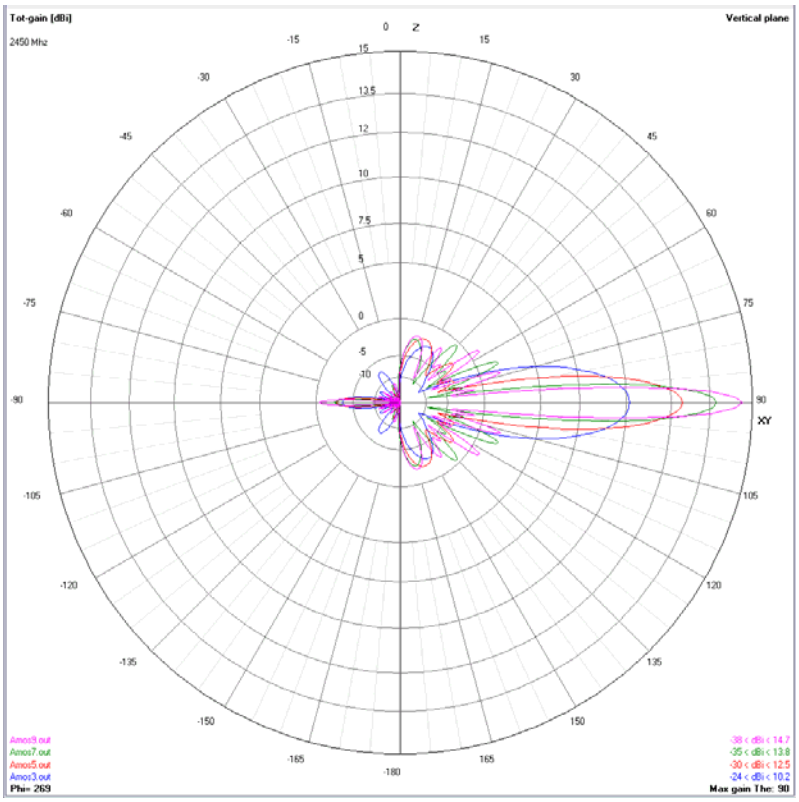

Fig. 2. Vertical radiation diagram of Amos antenna with different number of 3, 5, 7, and 9 dipoles.

Inverted Amos antenna

After successful construction of the Amos antenna, I was curios to see what would happen if I tried to take advantage of the short circuits at the end of the phasing lines radiation and get higher gain from the antenna. Instead of suppressing this parasitic radiation by converting the short circuit wires at the end of phasing lines in transmission line with help of reflector vicinity, I decided to try to take advantage of this parasitic radiation as a constructive part of my new antenna.

By rotating radiator 180 deg. and with additional optimization of dipoles and phasing lines dimensions I got an antenna with higher gain and a little narrower horizontal diagram. It is obvious that this undesired parasitic radiation now became a constructive part of the antenna's overall radiation and with its properly phased currents and fields improved Amos antenna in a way that increases gain and narrows the horizontal diagram. In fact, the horizontal diagram became narrower but not too much and the antenna preserves all good characteristics of the Amos antenna. The Inverted Amos antenna is very useful as a sector antenna if you need a narrower horizontal angle of coverage than Amos antenna has. It is interesting to see comparative diagrams of Amos and Inverted Amos antenna each with seven dipoles. It is obvious that the vertical radiation angle stayed almost unchanged as expected, but the horizontal diagram became narrower and gain increased. See **Fig. 3** and **4**.

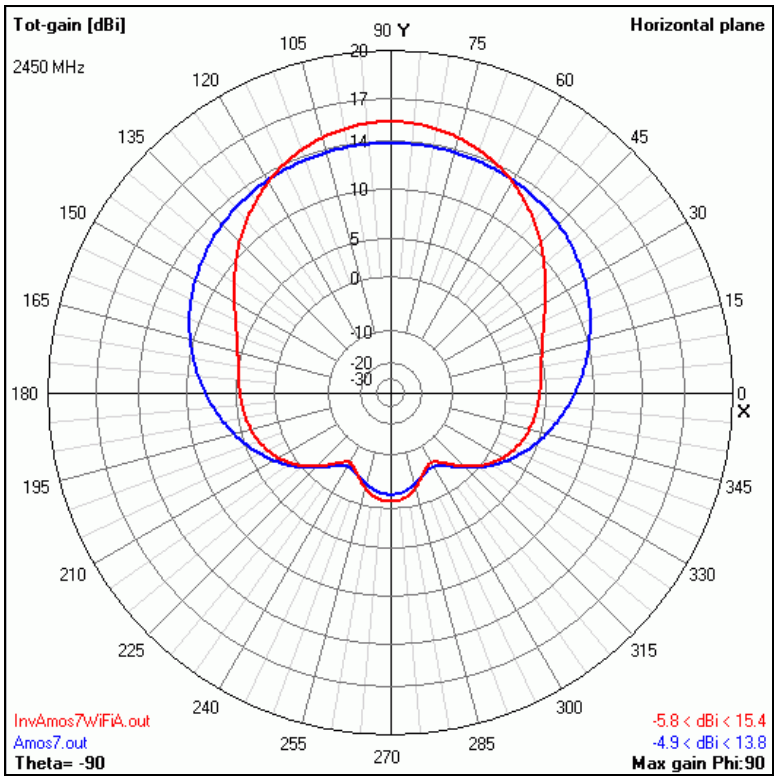

Fig. 3. Horizontal radiation diagram of Amos and Inverted Amos antenna with 7 dipoles.

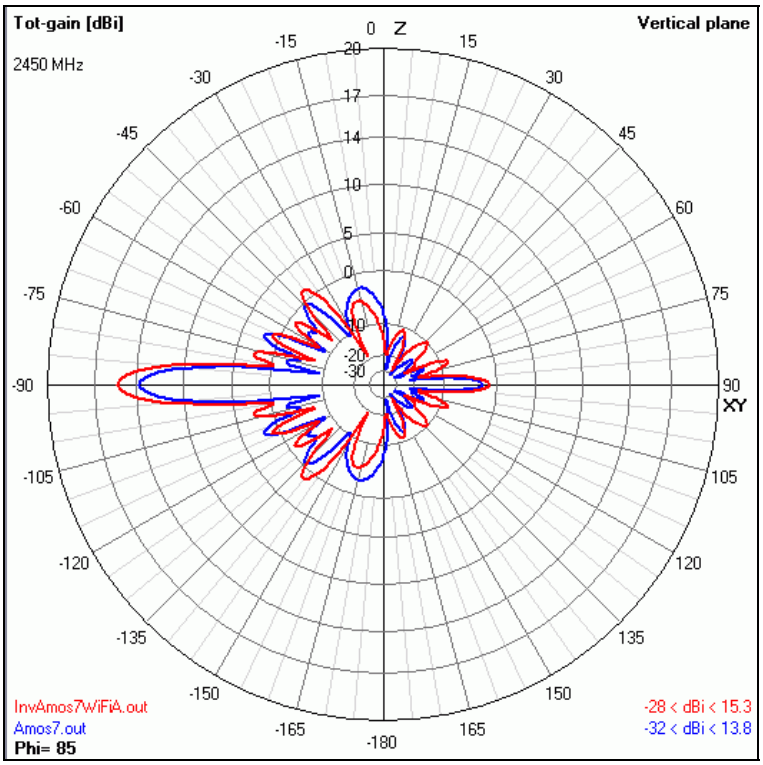

Fig. 4. Vertical radiation diagram of Amos and Inverted Amos antenna with 7 dipoles.

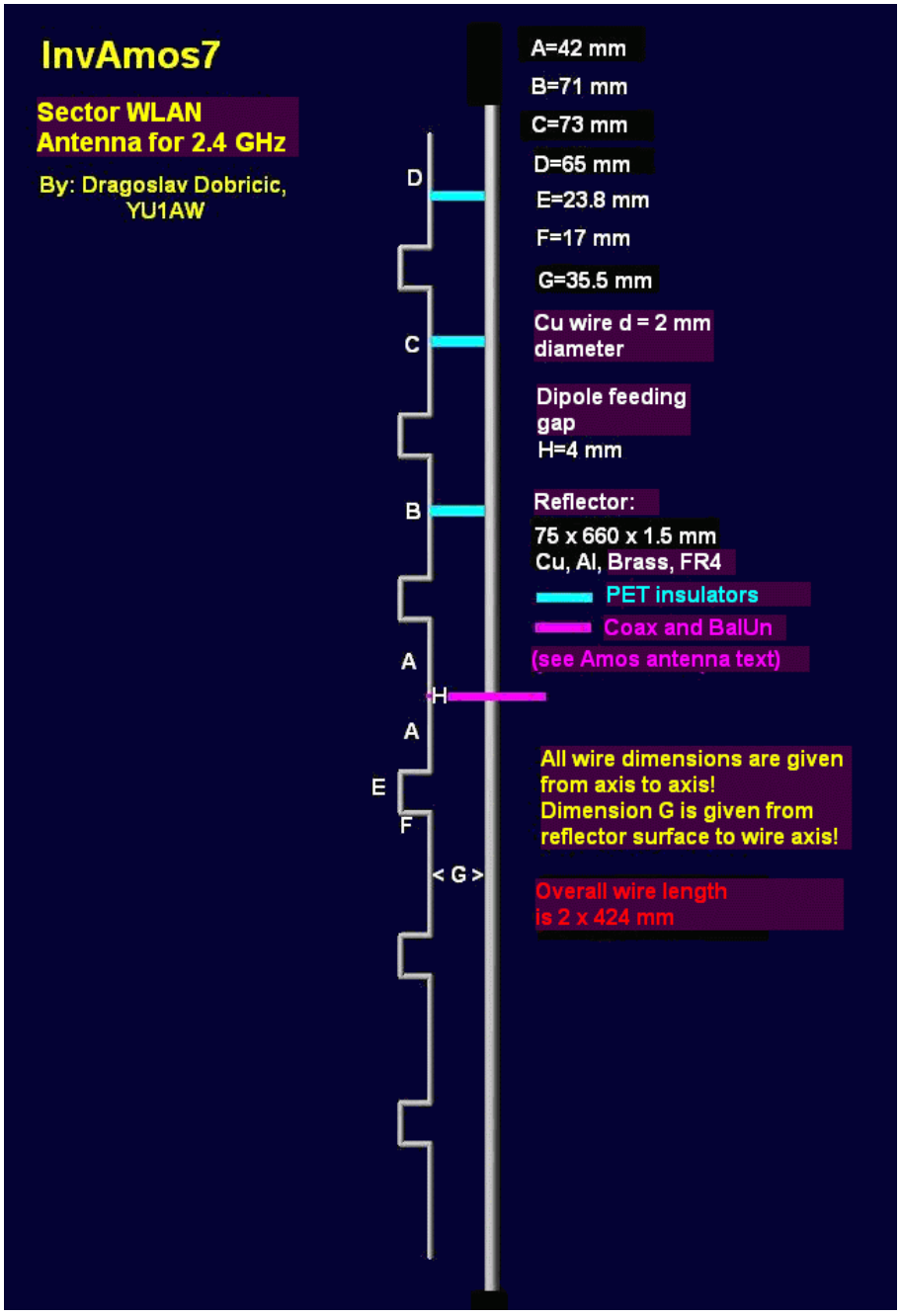

Fig. 5. Dimensions of Inverted Amos antenna with 7 dipoles.

Inverted Amos antenna construction

The inverted version of Amos antenna is built in the same way as Amos antenna, as explained in my article [1]. Everything said about Amos antenna construction could be said also for Inverted Amos, except of different dimensions for dipoles, phasing lines and reflector. These new dimensions for Inverted Amos antenna with 7 dipoles are given at **Fig. 5**. Feeding and the 1:4 half wavelength coax cable BalUn construction is same as for Amos antenna because of the same input impedance of antenna of about 200 Ohms. The gain of Inverted Amos antenna also

depends on number of vertically stacked dipoles. At **Fig. 11** and **Fig. 12** are given diagrams of different Inverted Amos antennas with different number of dipoles: 3, 5, 7 and 9.

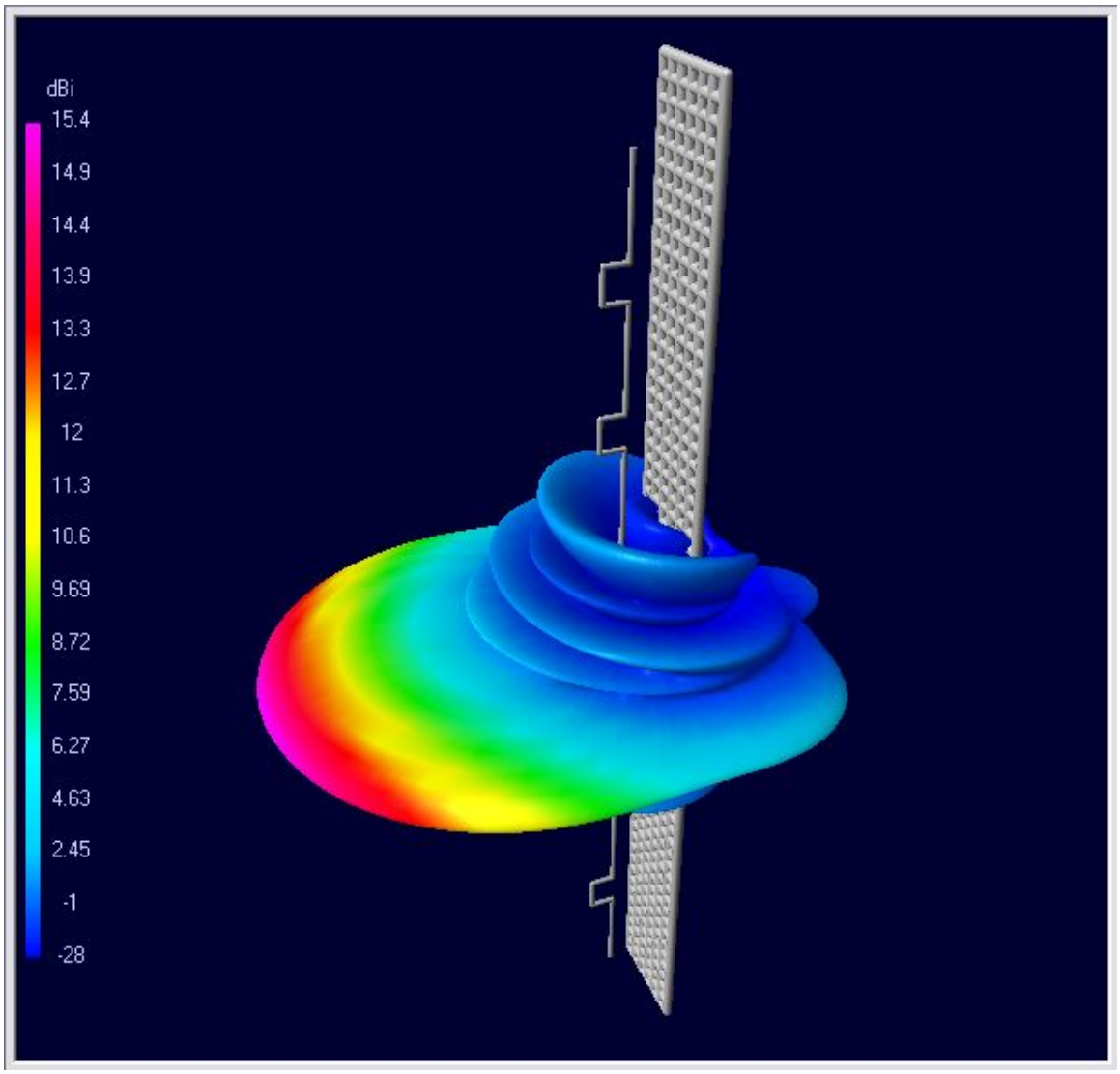

Fig. 6. 3D radiation diagram of Inverted Amos antenna with 7 dipoles.

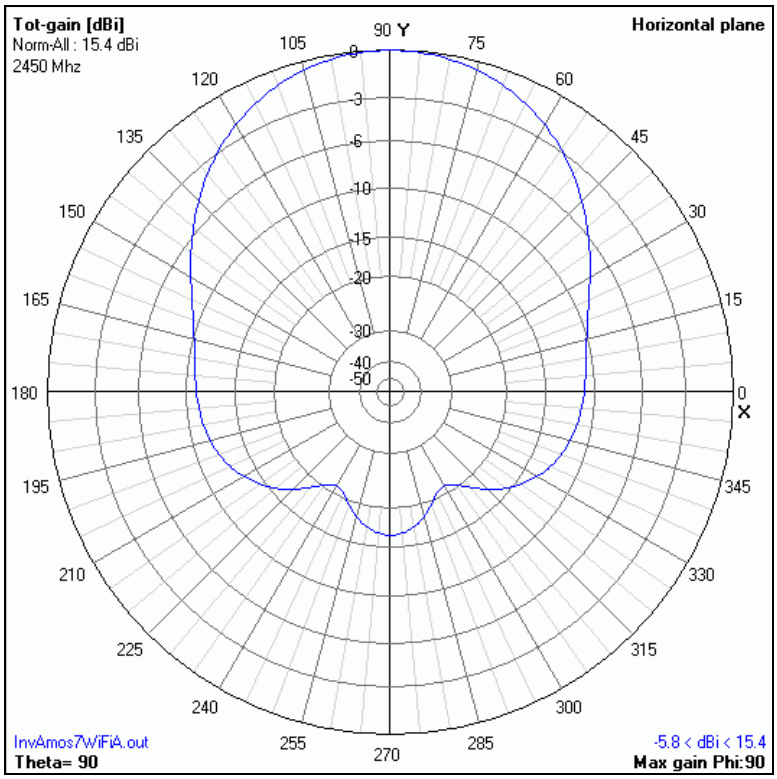

Fig. 7. Horizontal radiation diagram of Inverted Amos antenna with 7 dipoles.

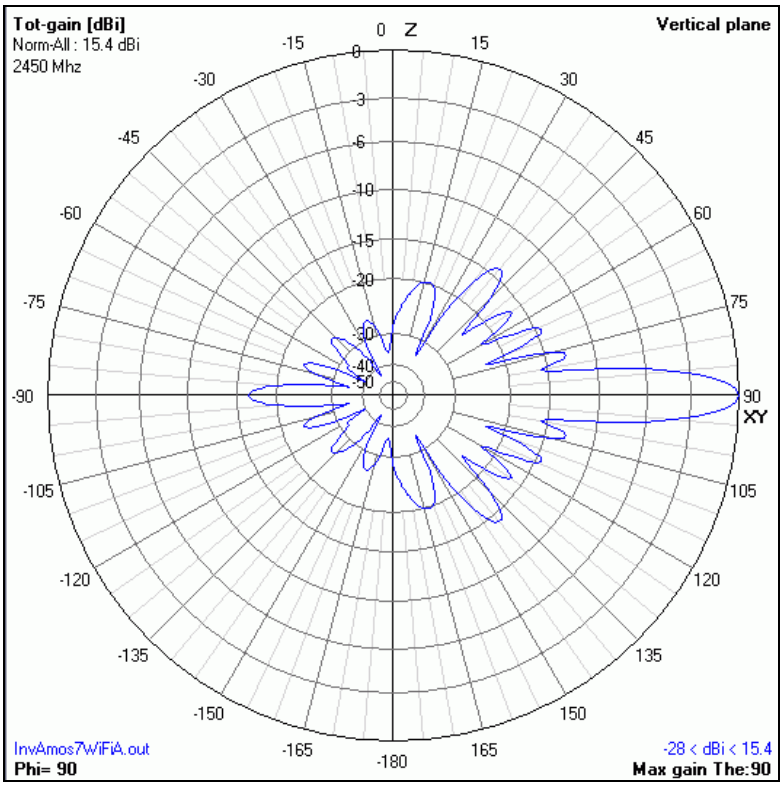

Fig. 8. Vertical radiation diagram of Inverted Amos antenna with 7 dipoles.

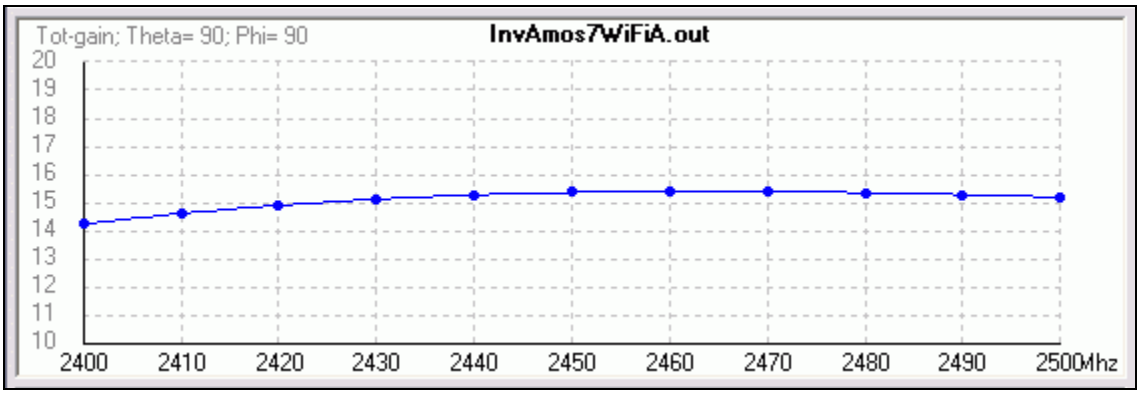

Fig. 9. Inverted Amos antenna gain diagram.

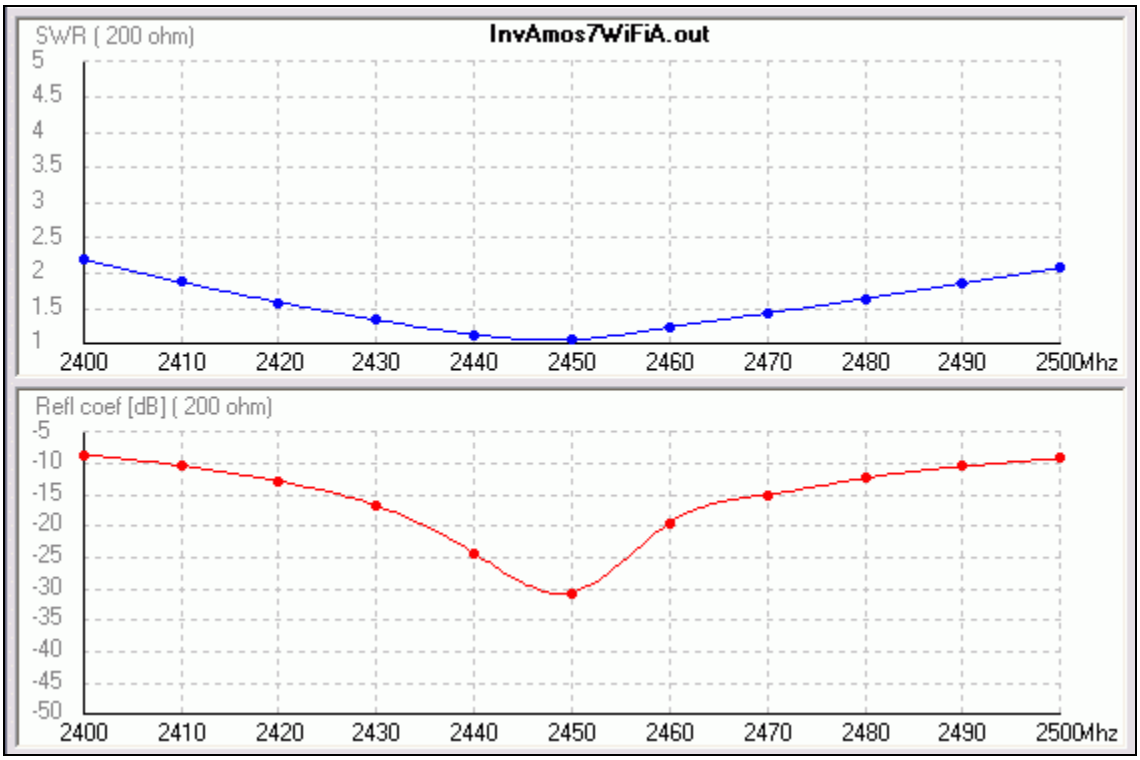

Fig. 10. SWR and Return loss diagram of Inverted Amos antenna with 7 dipoles.

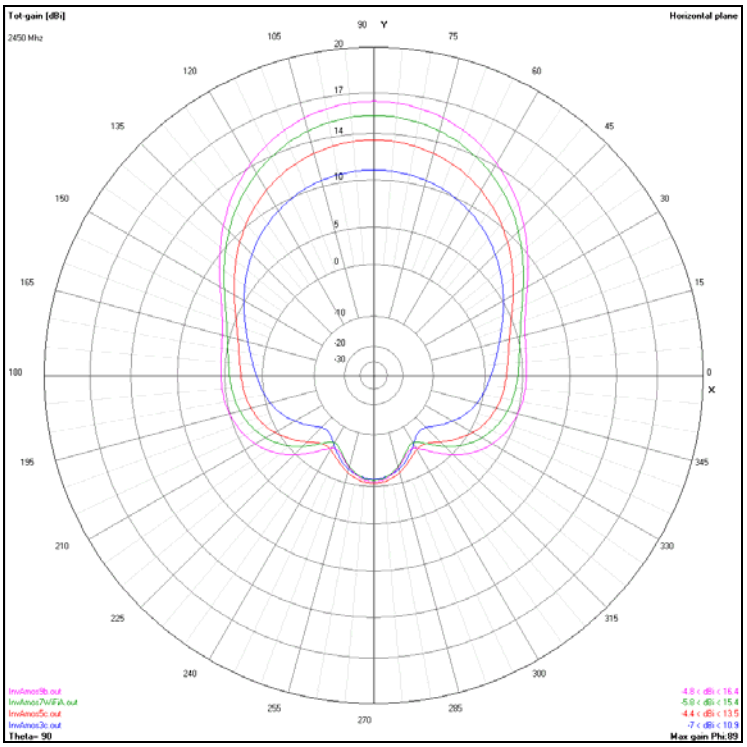

Fig. 11. Horizontal radiation diagram of Inverted Amos antenna with different number of 3, 5, 7, and 9 dipoles.

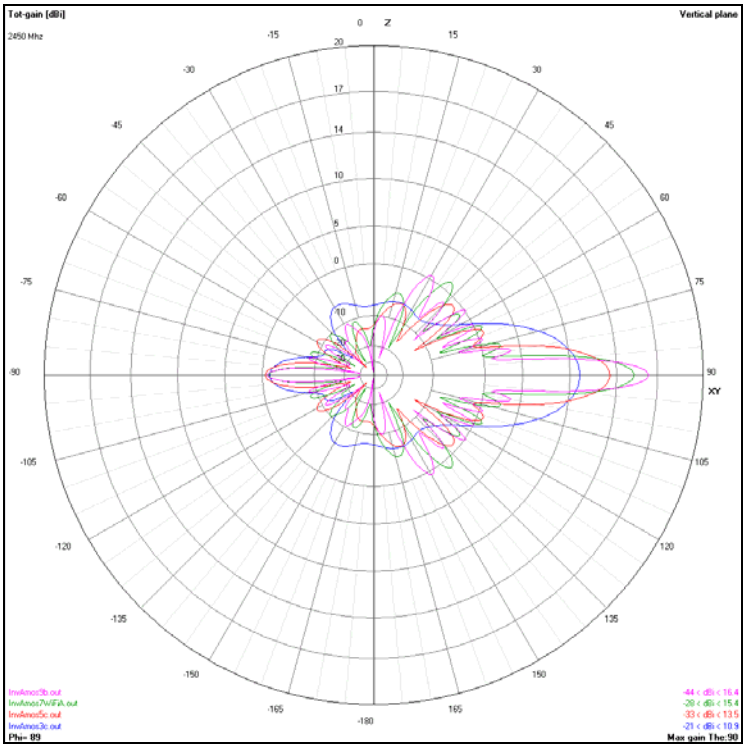

Fig. 12. Vertical radiation diagram of Inverted Amos antenna with different number of 3, 5, 7, and 9 dipoles.

Fig. 13. Inverted Amos antenna with 7 dipoles.

Fig. 14. Inverted Amos antennas with 5 and 7 dipoles.

Fig. 15. Finished Inverted Amos antennas with 5 and 7 dipoles and the reflector for not yet finished antenna with 9 dipoles.

Fig. 16. Finished Inverted Amos antennas with 7 dipoles ready for mounting.

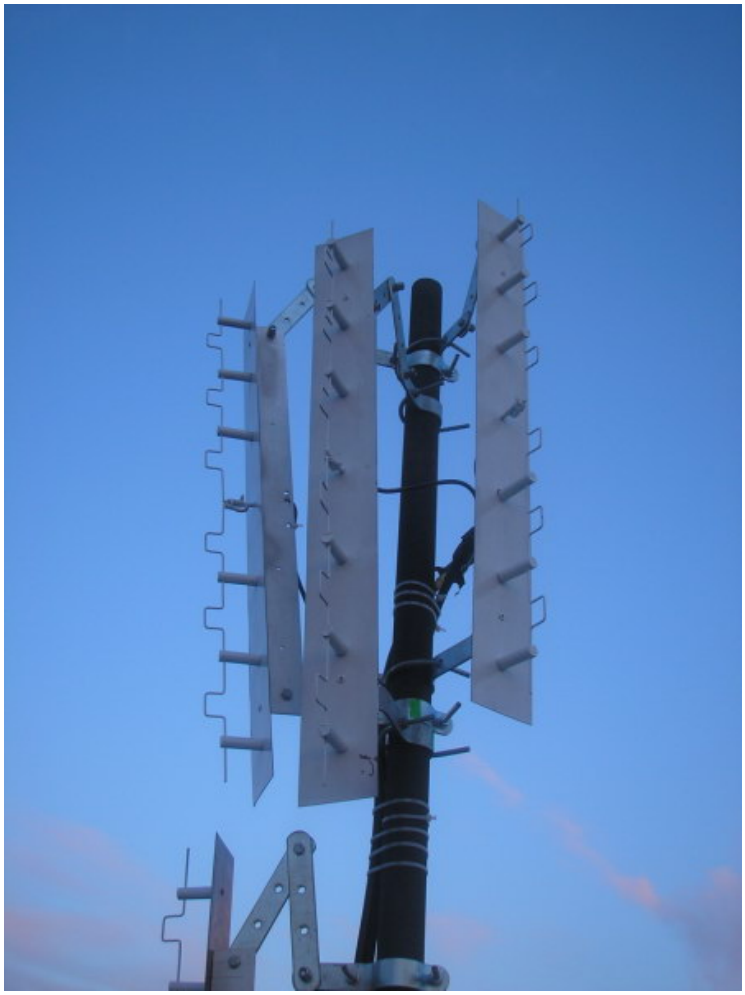

Fig. 17. Mounted Inverted Amos antennas with 7 dipoles at an Access Point location.

Fig. 18. Inverted Amos antennas with 7 dipoles at WLAN Access Point location.

Conclusion

In this article I wanted to show that it is possible to use parasitic phasing line radiation as a constructive addition to improve overall antenna performance. It is possible to achieve this without sacrificing other good performance features of the initial antenna except narrowing horizontal diagram of radiation. The new antenna has all of the good performance of the Amos antenna, but with higher gain and a narrower horizontal diagram of radiation. **-30-**

Reference

1. Amos Antenna, *antenneX* Issue No. 127 – November 2007.

BRIEF BIOGRAPHY OF THE AUTHOR

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. Married and has two grown up children, a son and a daughter.

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