



Effects of Fiberglass Poles on Radiation Patterns of Log-Periodic Antennas

by Christos E. Maragoudakis

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Effects of Fiberglass Poles on Radiation Patterns of Log-Periodic Antennas

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14. ABSTRACT The effects of fiberglass poles of various cross-section and chemical composition on the radiation pattern of log-periodic antennas are presented in this document. The antennas were mounted with the poles parallel to the antenna boom and vertical to the radiating elements. Normalized antenna patterns depicting the effects of the poles on the radiation pattern in the 100 megahertz (MHz) to 1 gigahertz (GHz) frequency range are included in the appendix of this document.					
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1. Introduction

Antennas are mounted in various ways depending on the antenna type and the intended application. The common method of mounting log periodic and Yagi antennas is by supporting them from the balance point on the boom using metal, wooden, or fiberglass poles. This technical note presents the results of an investigation that was performed to determine the effects of fiberglass poles on the radiation pattern of a log periodic antenna when the pole is parallel to the boom. The investigation was performed at the Electromagnetic Vulnerability Assessment Facility (EMVAF) of the U.S. Army Research Laboratory (ARL) Survivability/Lethality Analysis Directorate (SLAD) at White Sands Missile Range, NM.

2. Experimental Set-up

The test equipment used in the investigation included three fiberglass poles of different composition and cross-section, a Poly Vinyl Chloride (PVC) pole and two log periodic antennas. The transmit antenna was an Amplifier Research Log periodic, model AT-1080 while the receive antenna was a Creative Design Corp. model CLP 5130-2. The transmit antenna was mounted on the mast at the mezzine, while the receive antenna was mounted on the Howland antenna measurement tower at the end of the other end of the chamber. A diagram of the measurement set-up used is shown in figure 1.

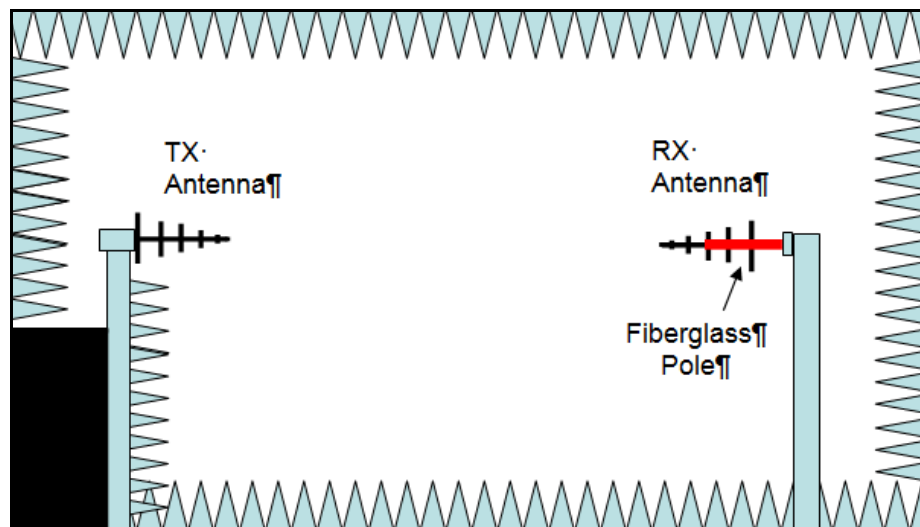


Figure 1. Experiment set-up.

The receive antenna was mounted on the tower using either one of the fiberglass poles or the PVC pole. The poles were placed parallel to the boom (a beam that the radiating elements are

attached to) of the antenna and vertical relative to the antenna radiating elements. The two tubular fiberglass poles had a 2-inch outside diameter and a wall thickness was 0.25 inches, while the third fiberglass pole had a 3×3-inch cross-section and a 0.25-inch wall thickness. The last pole used was a schedule 40 PVC pole with an outside diameter of 1.875 inches. Figure 2 depicts the receive antenna mounted on the tower using one of the tubular poles.



Figure 2. Log periodic antenna mounted with a tubular fiberglass pole.

3. Results

All measurements were made with both antennas vertically polarized. During the measurements the frequency was varied from 100 megahertz (MHz) to 1 gigahertz (GHz) in 100 MHz steps while the receive antenna was rotated from 0° to 360° in 2° steps in the azimuth plane. Figure 3 depicts the normalized antenna pattern measured at 200 MHz. Additional antenna patterns are shown in the appendix.

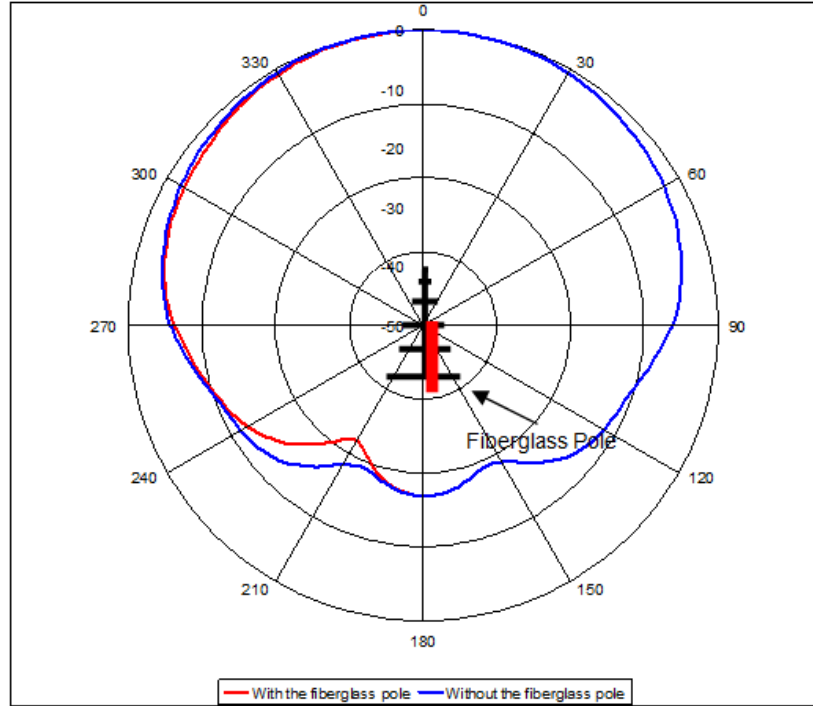


Figure 3. Antenna pattern for 200 MHz using tubular fiberglass pole 1.

4. Conclusions

As seen from the antenna patterns measured, the patterns are being affected by the presence of the fiberglass pole. The amount of antenna pattern degradation is a function of carbon content in the fiberglass pole, frequency of operation and position of the antenna relative to the pole. Even though the effect is minimal, less than 2 decibels (dB), for the configuration tested, it may be critical for other applications.

5. Recommendations

Because preliminary results show that fiberglass poles could affect the antenna patterns, it is recommended that additional studies be made so that the effects of fiberglass on the antenna performance are better understood. The studies should include the placement of other commonly used antennas, such as vertical antennas, at various distances from the fiberglass poles.

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Appendix. Antenna Patterns

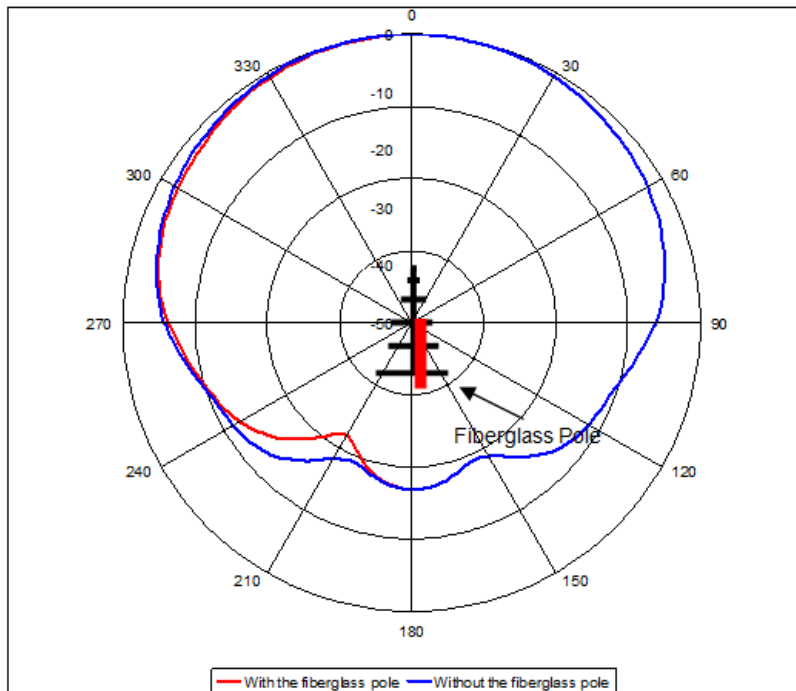


Figure A-1. Antenna pattern for 200 MHz using tubular fiberglass pole 1.

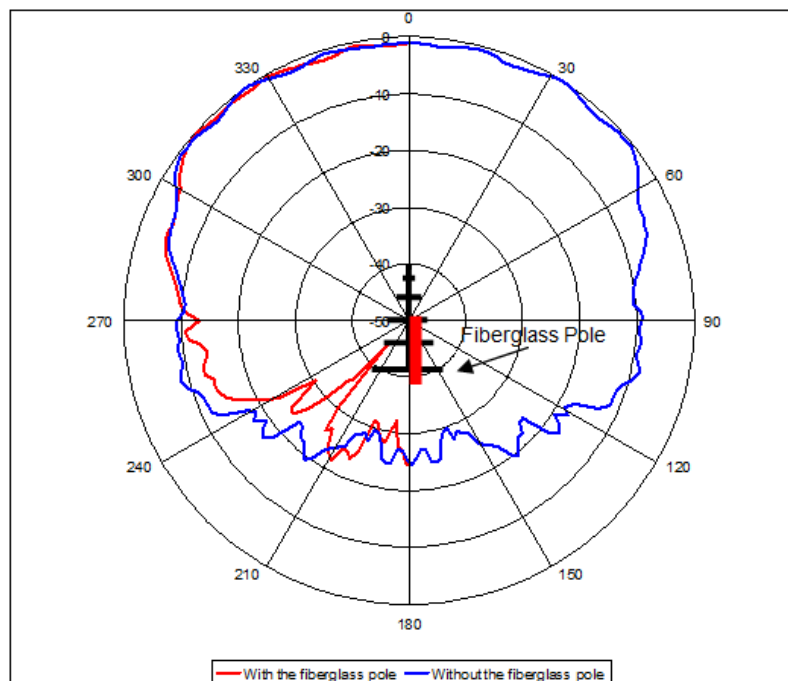


Figure A-2. Antenna pattern for 900 MHz using tubular fiberglass pole 1.

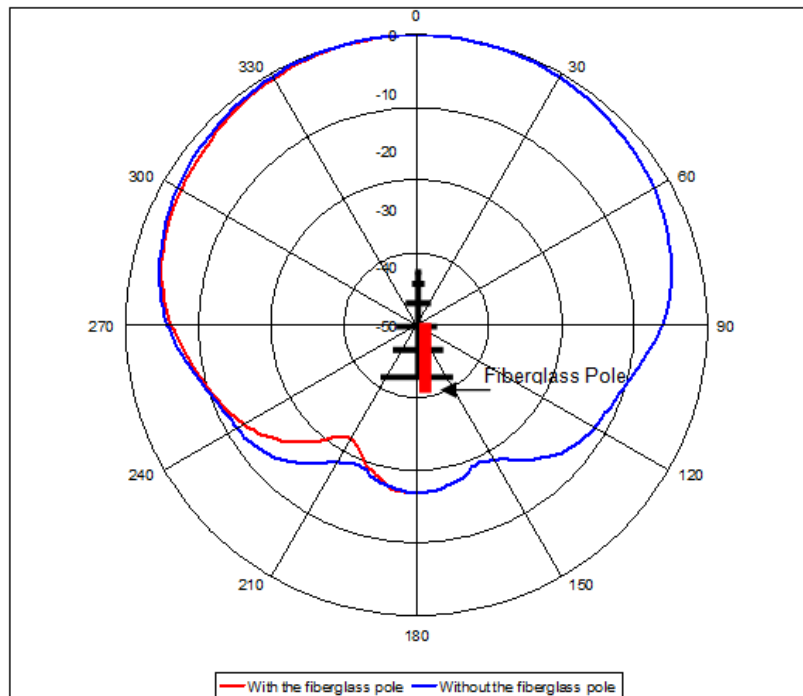


Figure A-3. Antenna pattern for 200 MHz using tubular fiberglass pole 2.

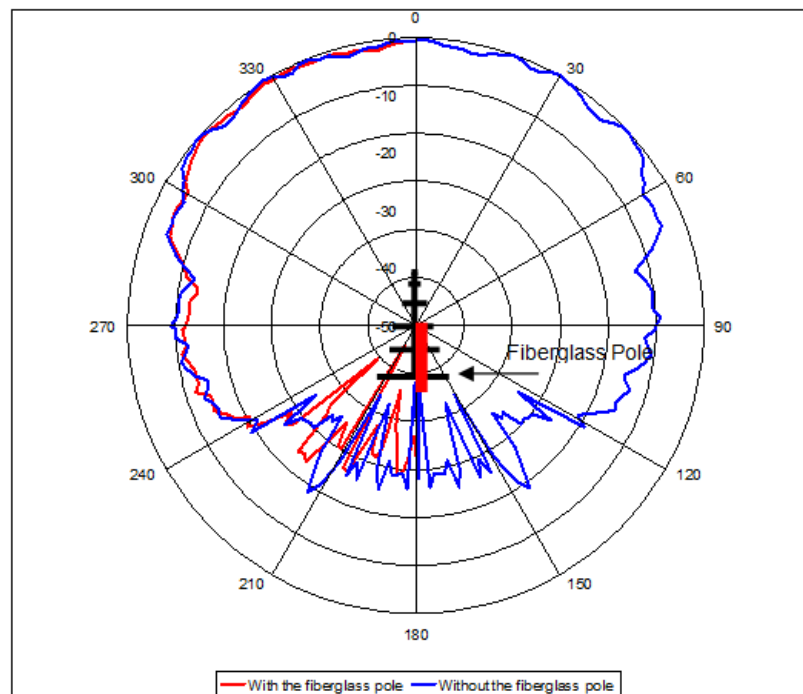


Figure A-4. Antenna pattern for 900 MHz using tubular fiberglass pole 2.

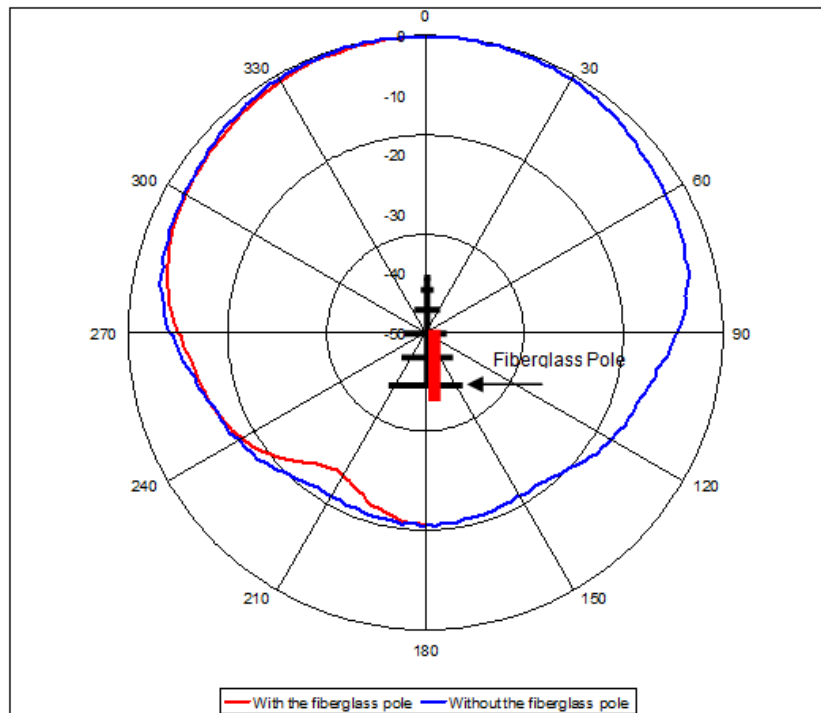


Figure A-5. Antenna pattern for 200 MHz using square fiberglass pole.

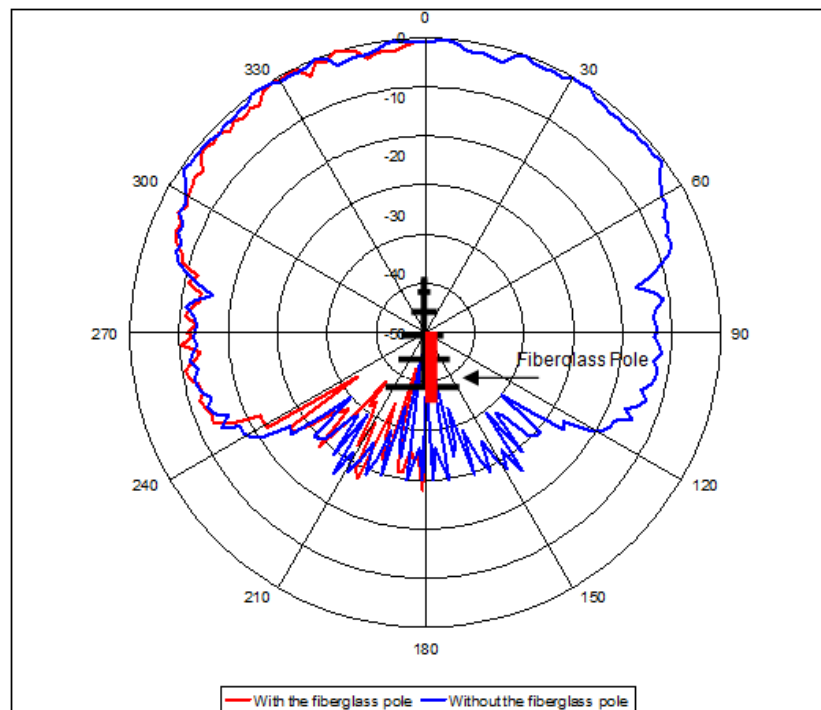


Figure A-6. Antenna pattern for 900 MHz using square fiberglass pole.

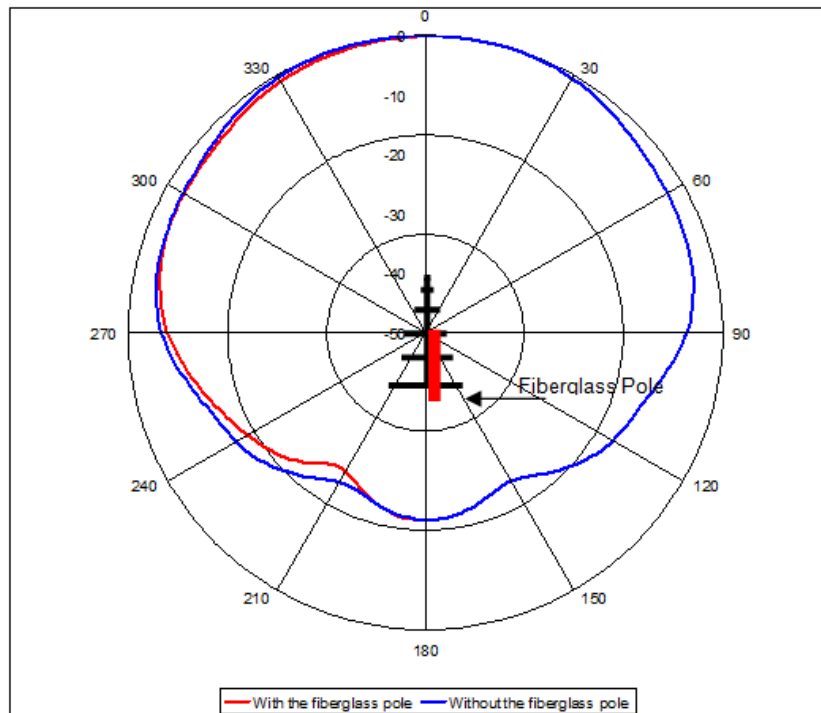


Figure A-7. Antenna pattern for 200 MHz using the PVC pole.

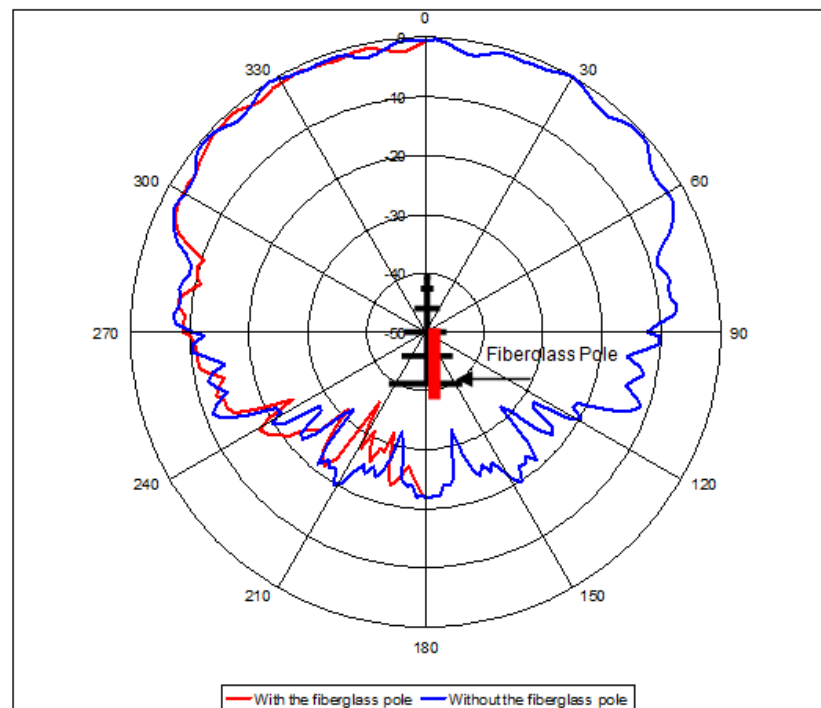


Figure A-8. Antenna pattern for 900 MHz using the PVC pole.

List of Symbols, Abbreviations, and Acronyms

ARL	U.S. Army Research Laboratory
dB	decibels
EMVAF	Electromagnetic Vulnerability Assessment Facility
GHz	Gigahertz
MHz	megahertz
PVC	Poly Vinyl Chloride
SLAD	Survivability/Lethality Analysis Directorate

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