Comparison of Measured and Calculated Current Distribution on the KinStar Low Profile MF Antenna

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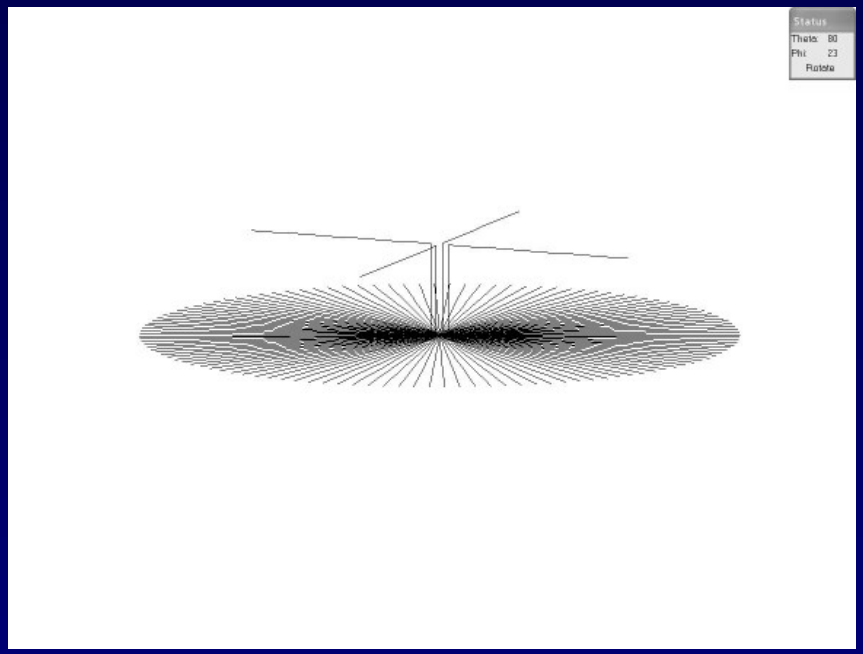
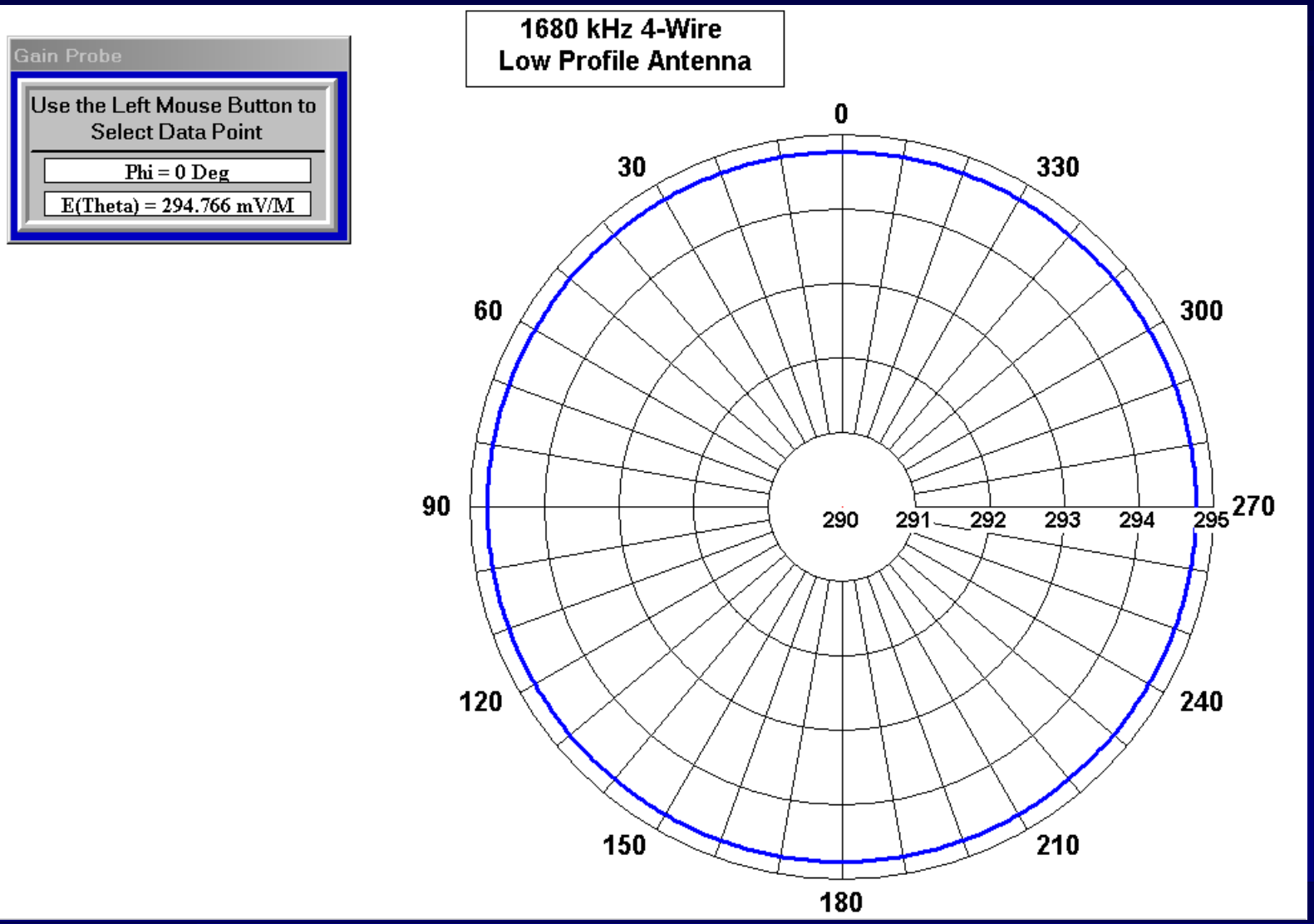
The KinStar Low-Profile Antenna

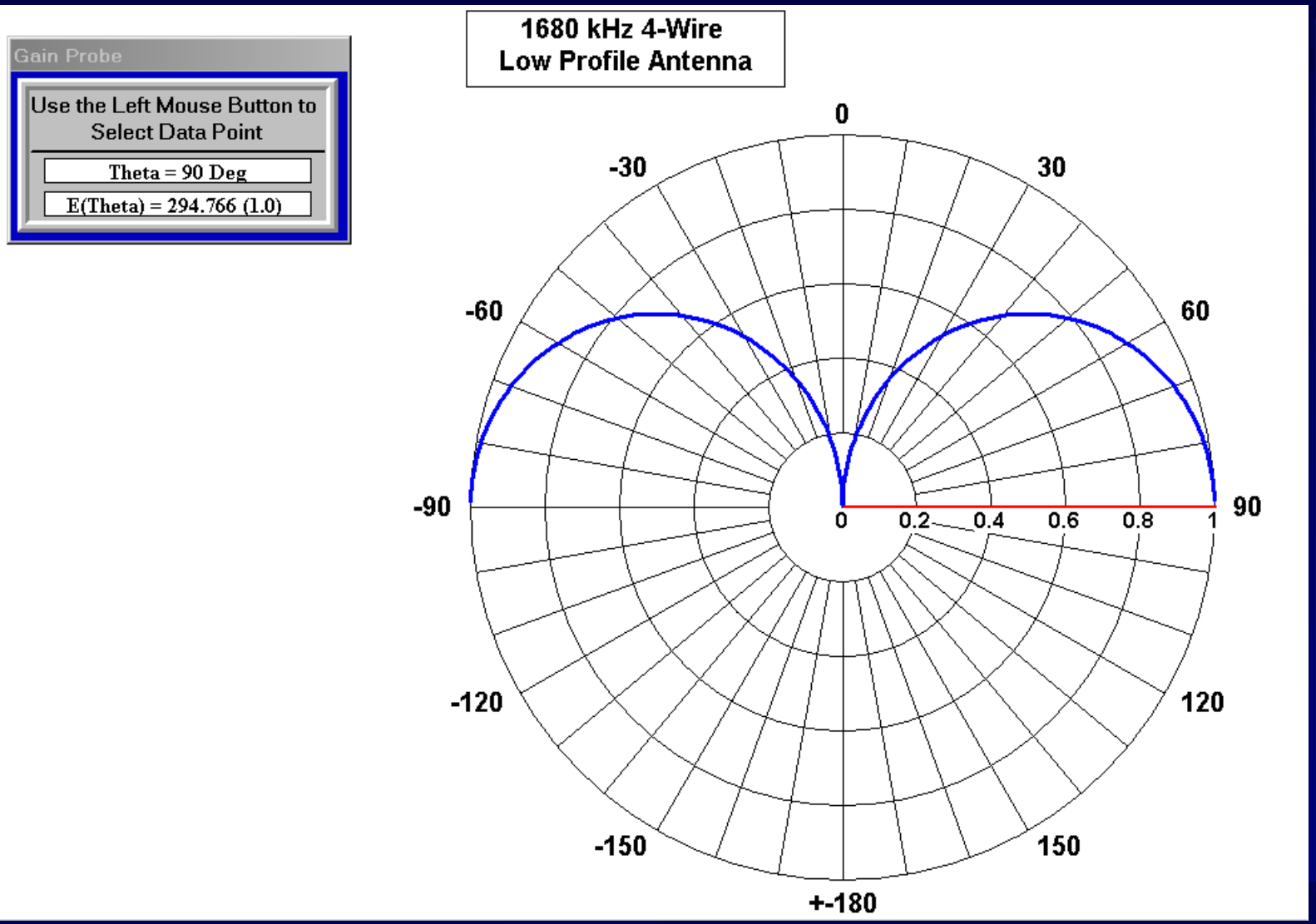


- Introduced at 2002 BTS.
- Approximately 0.06 wavelengths high.
- Uses standard quarterwave 120-radial ground screen.
- Meets FCC Class B,C,D minimum efficiency requirements.
- Constructed using stranded wire conductors and common overhead line hardware.

Predicted Azimuth Field Pattern



Predicted Elevation Field Pattern

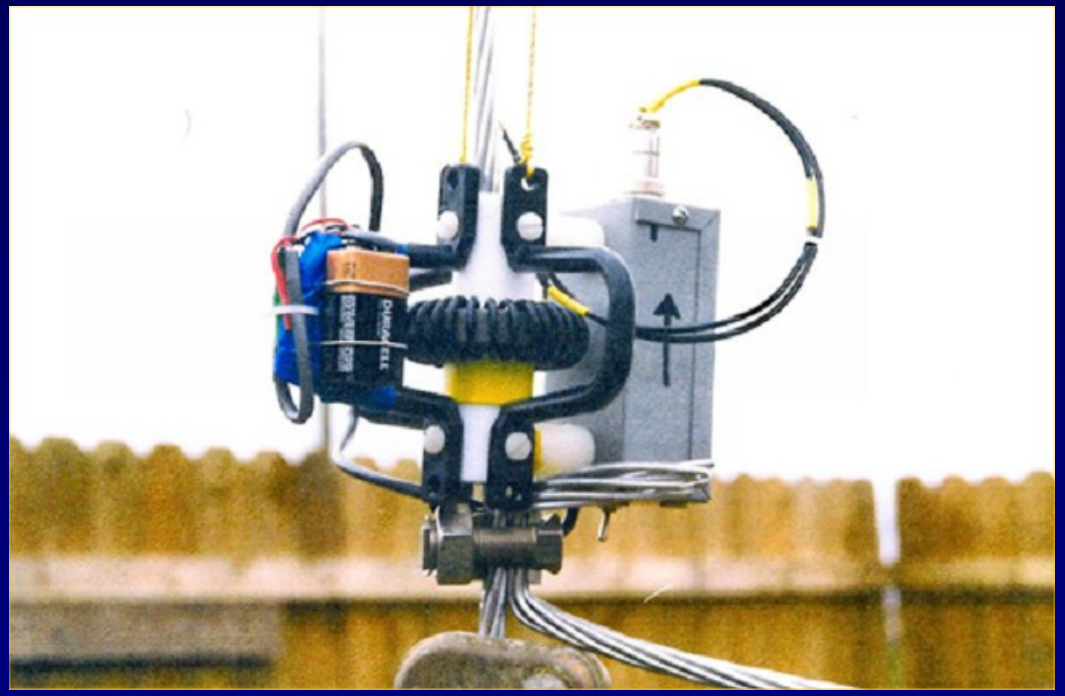


Full-Scale Prototype Testing

- Full field proof conducted to verify efficiency and omnidirectional characteristics.
- Results confirmed predictions.
- Tested several impedance matching methods.
- Conducted current distribution measurements on vertical wires.

Current Measurements

- Self-contained sensing coil and data logging unit made by Kintronic personnel.

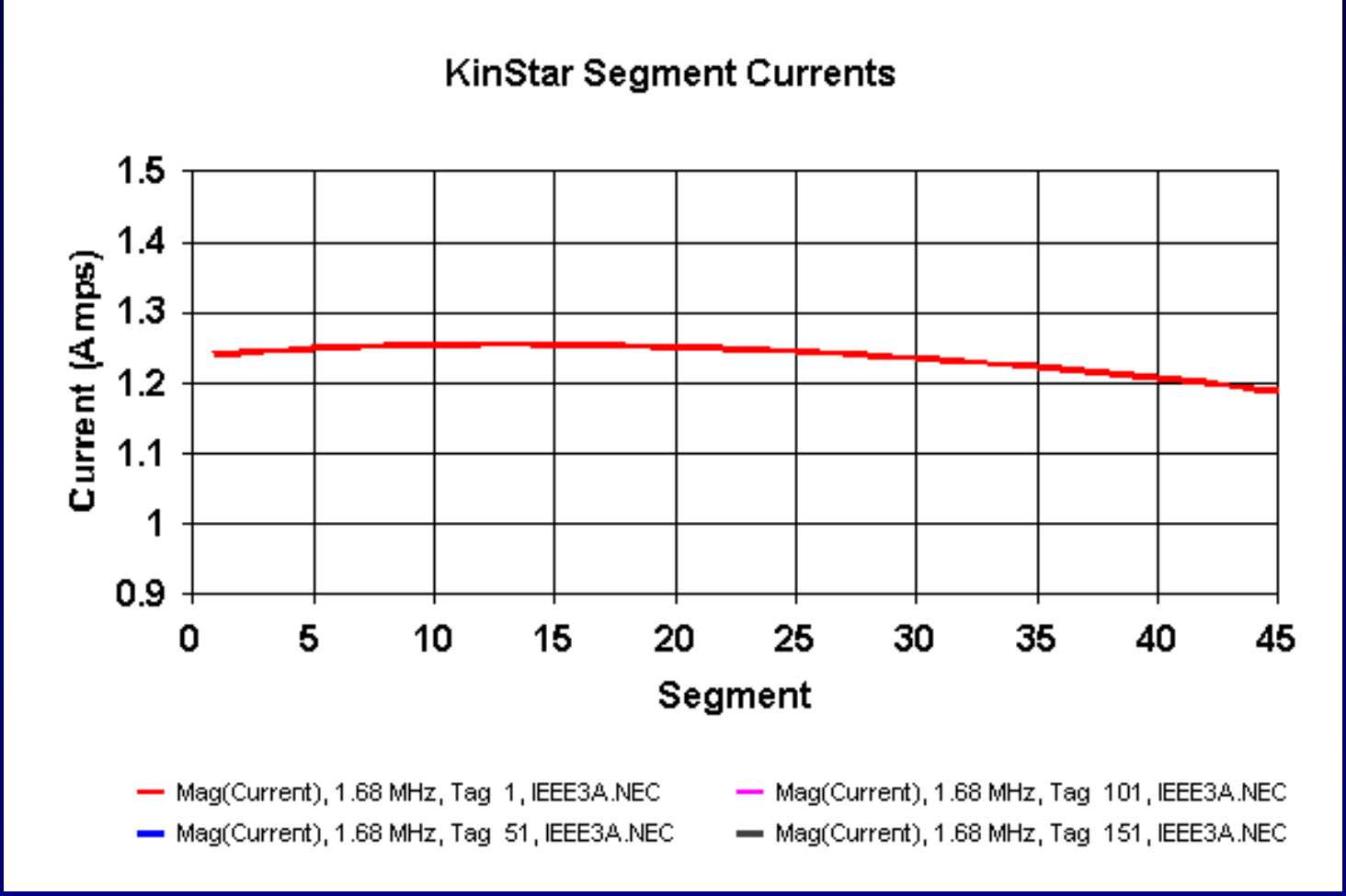


Test Cases

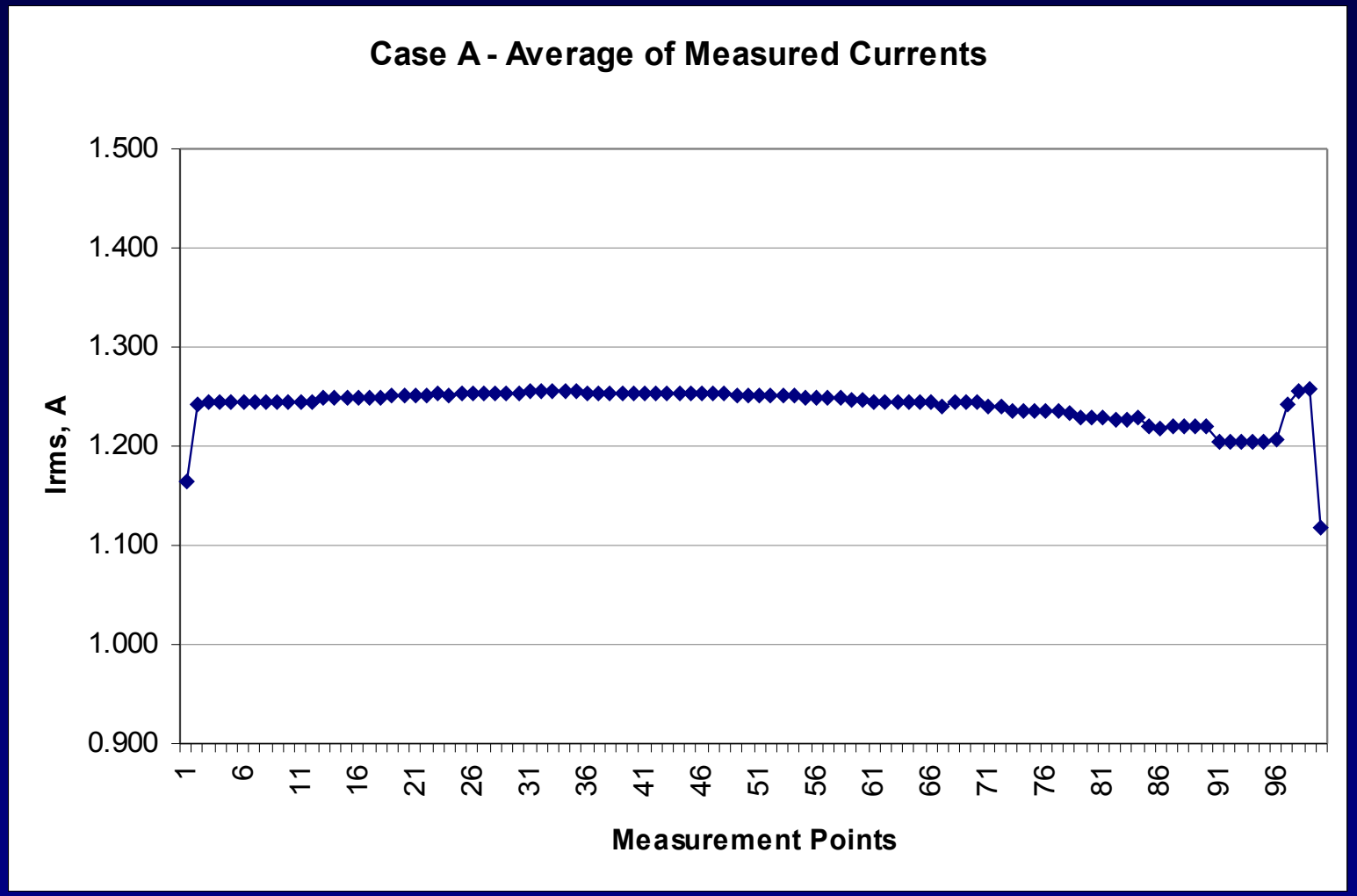
Case	Matching Method	Wires Shunted	Comments
A	Transmission Line	No	Boxes inside fence
B	Lumped Element	Bottom Only	Boxes inside fence
C	Lumped Element	Bottom and Top	Boxes inside fence
D	Lumped Element	Bottom and Top	Boxes 16ft. Outside
E	Transmission Line	No	Boxes 16ft. Outside

Case A: NEC Predicted Currents

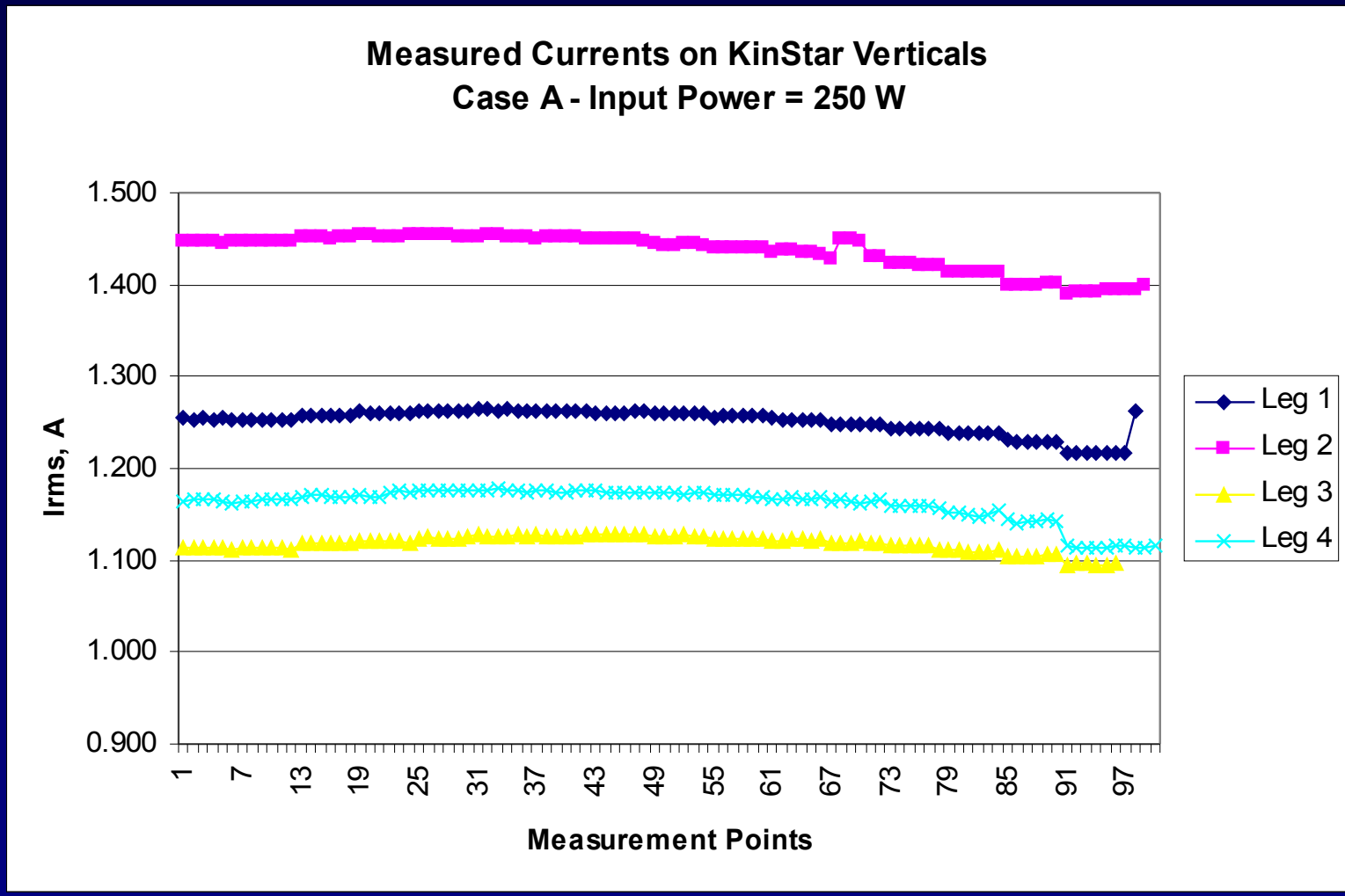
Individual Wires – Transmission Line Feed



Case A: Averaged Currents

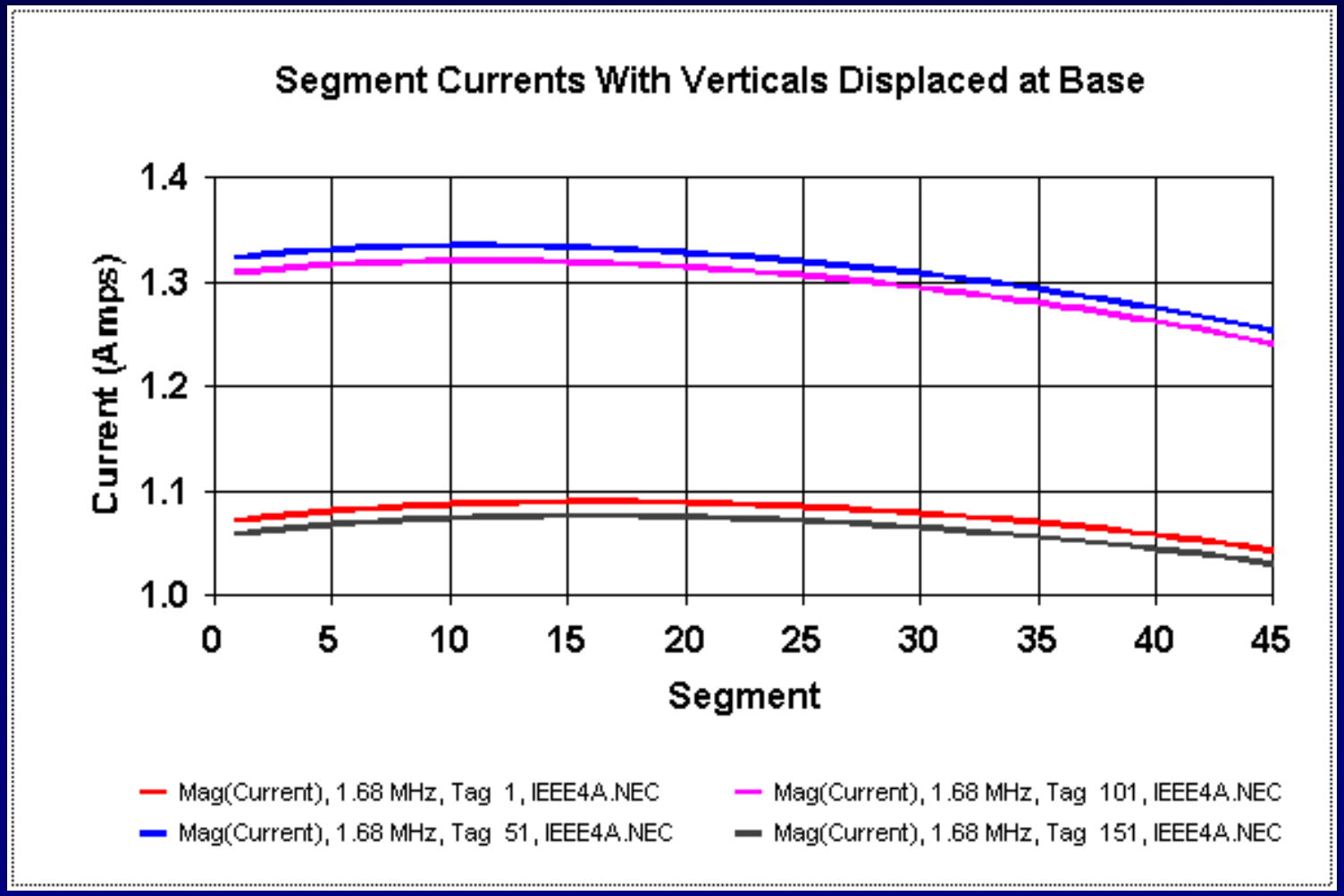


Case A: Individual Measured Currents



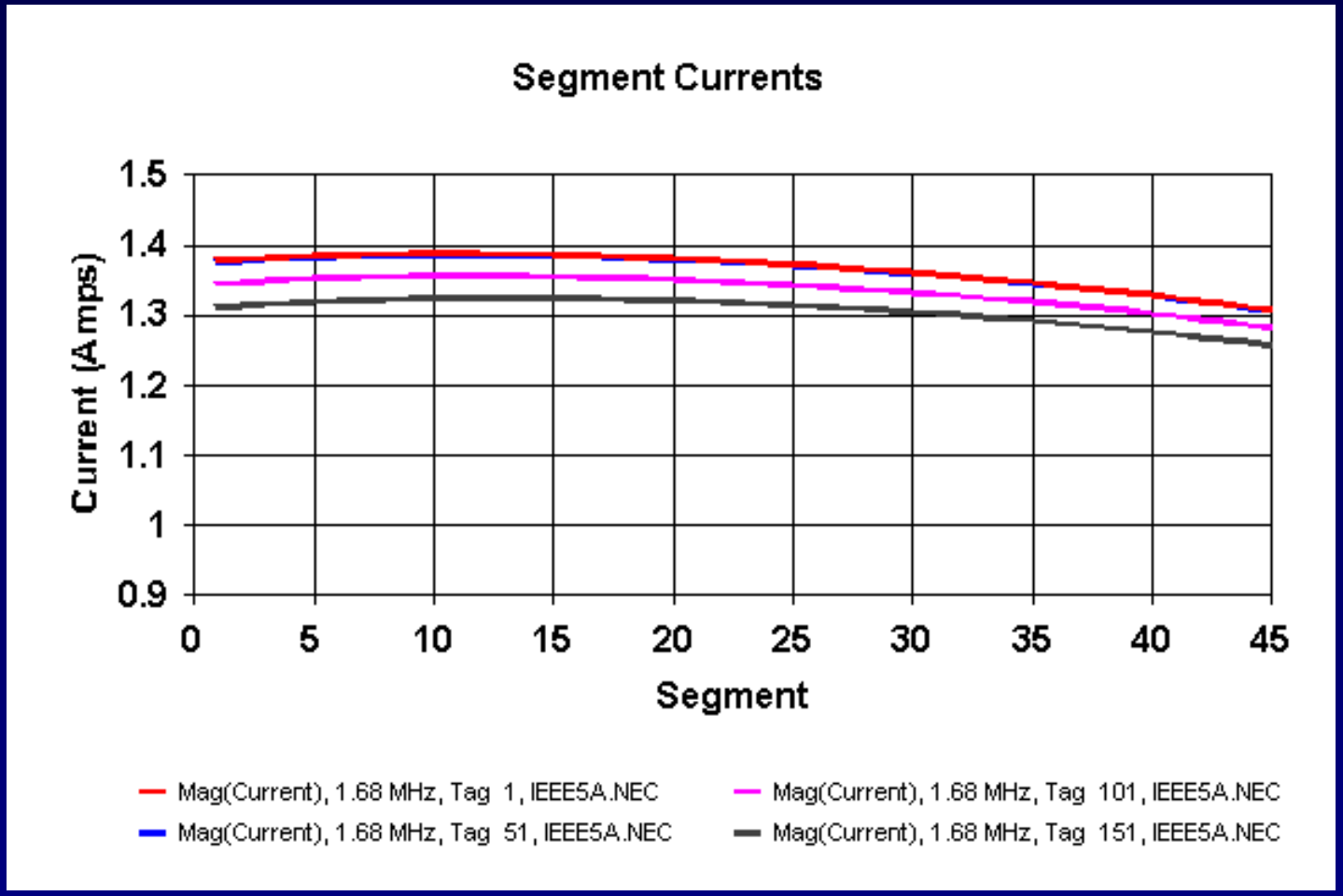
Case A: NEC Modeled Currents

with wires 1 foot out of position



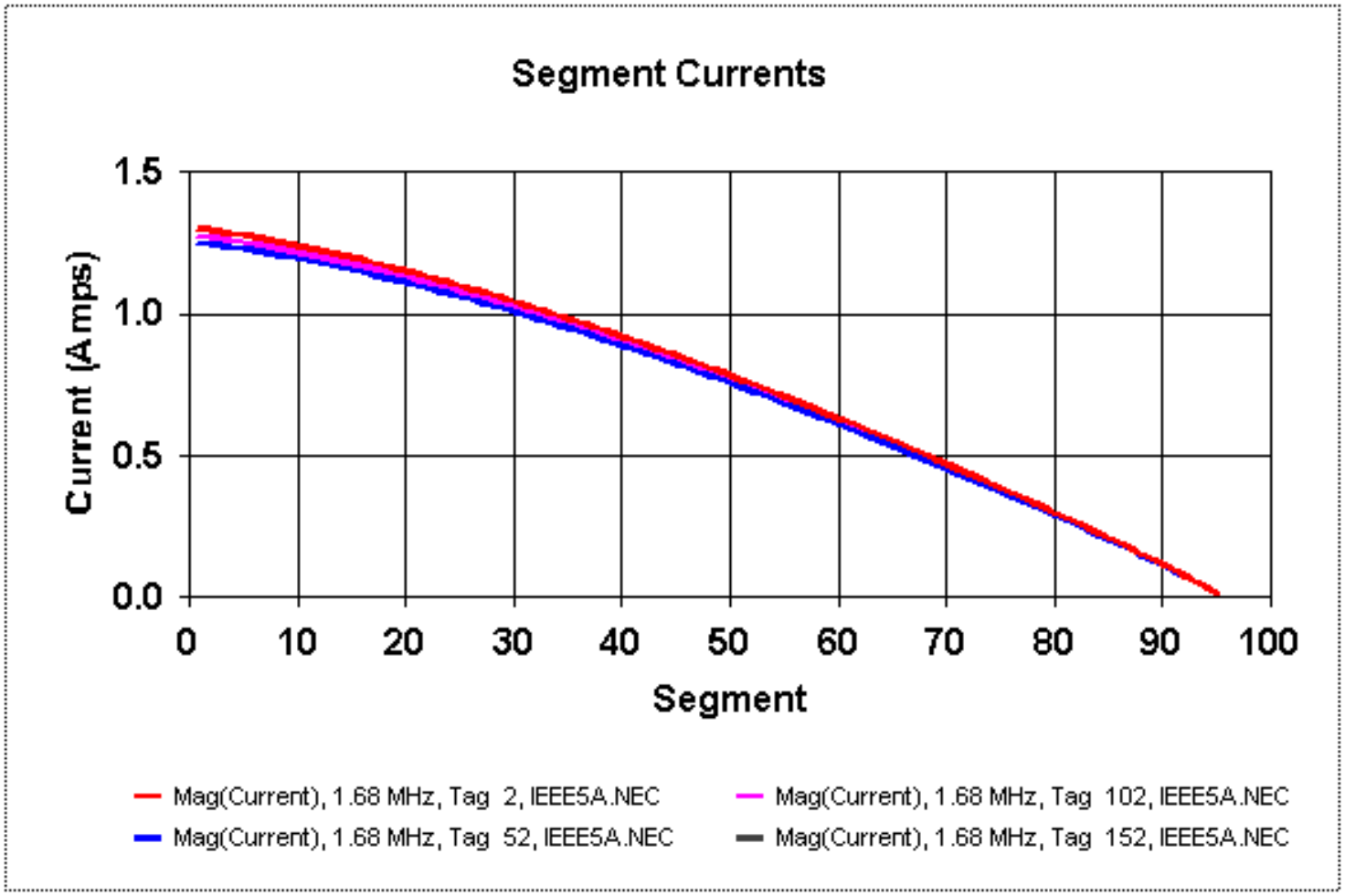
Case A: NEC Modeled Currents

using as-built dimensions – Vertical Wires



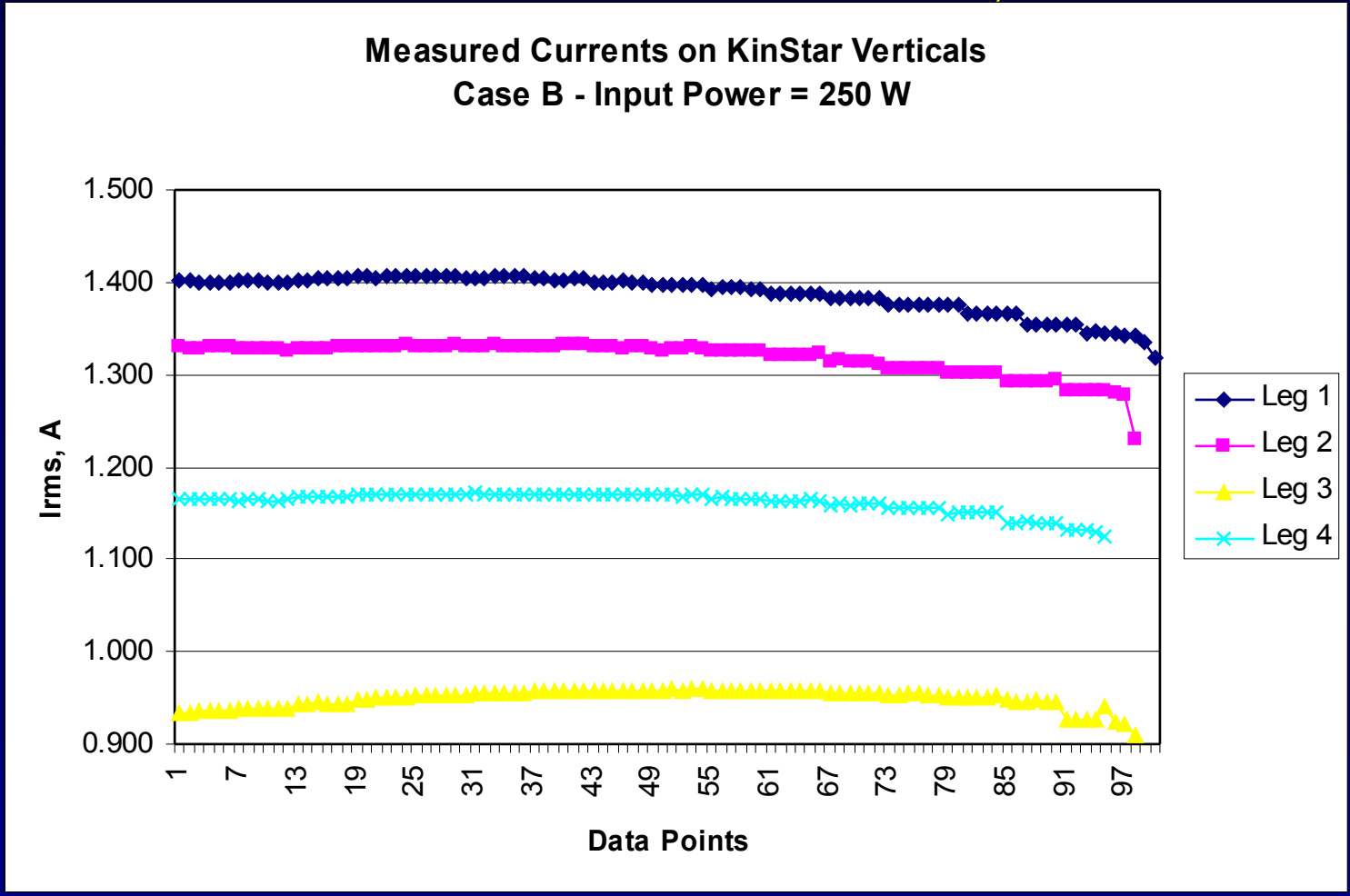
Case A: NEC Modeled Currents

using as-built dimensions – Horizontal Wires



Case B: Measured Currents

Wires Shunted – Bottom Only



Case B: Averaged Currents

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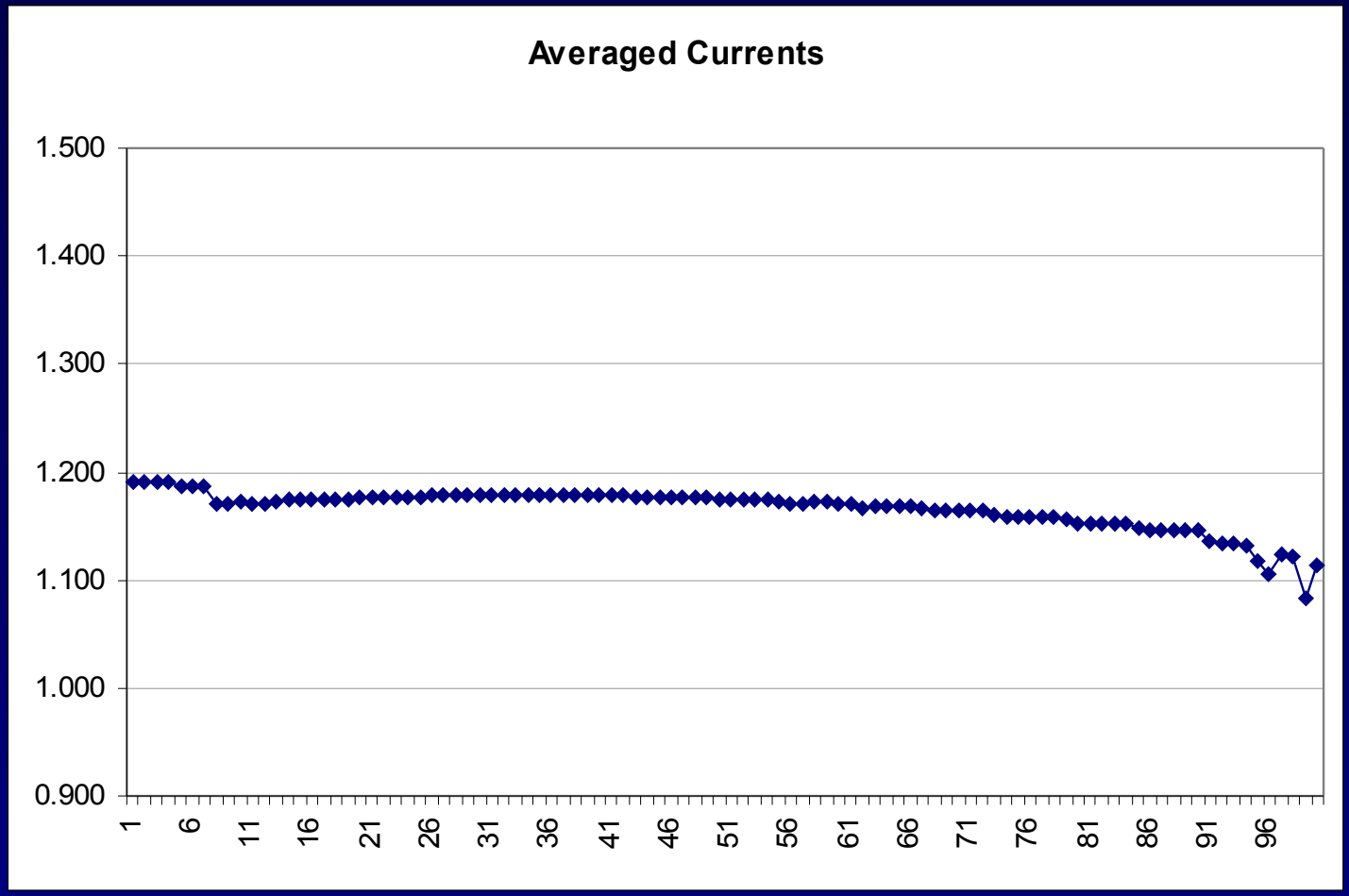
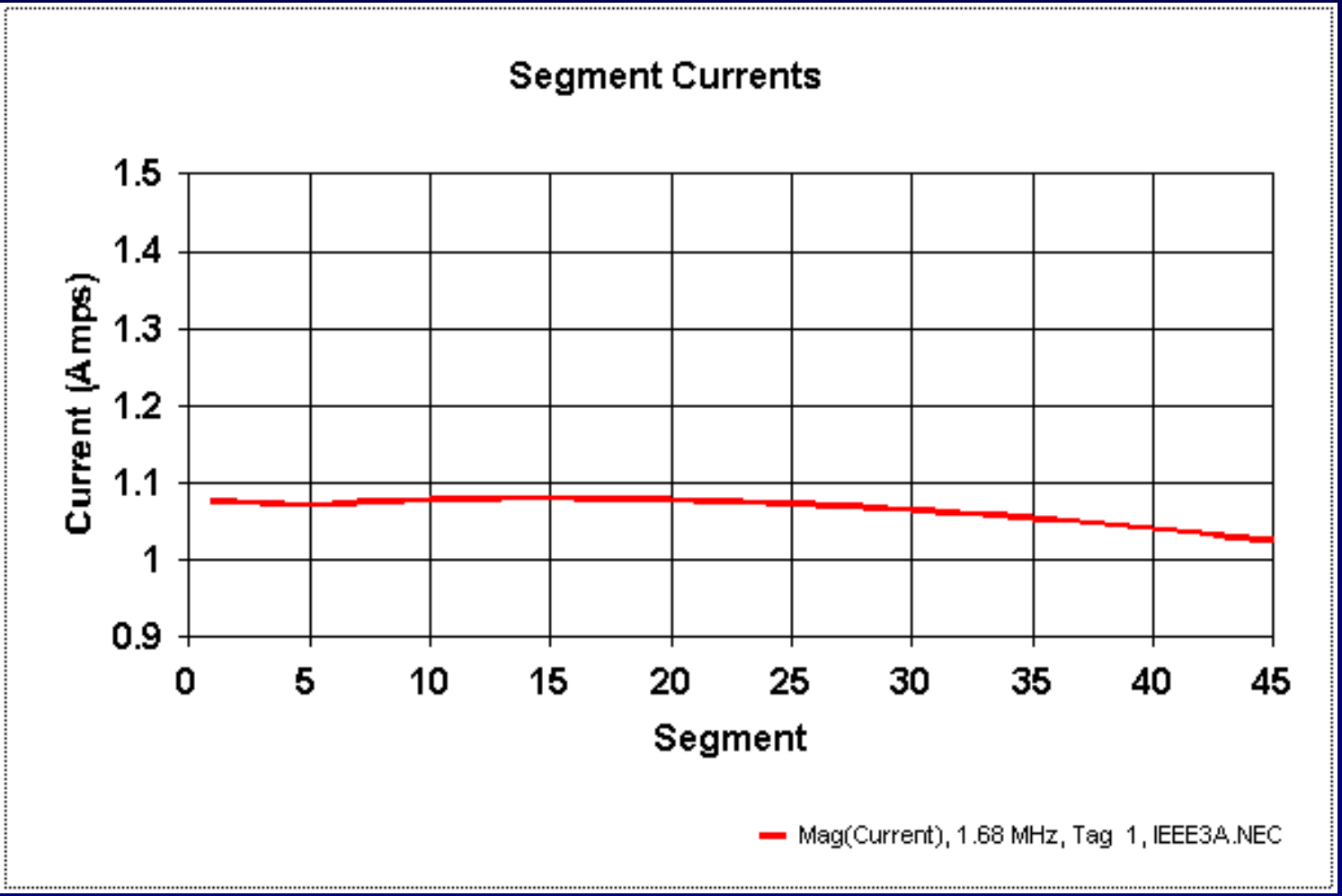


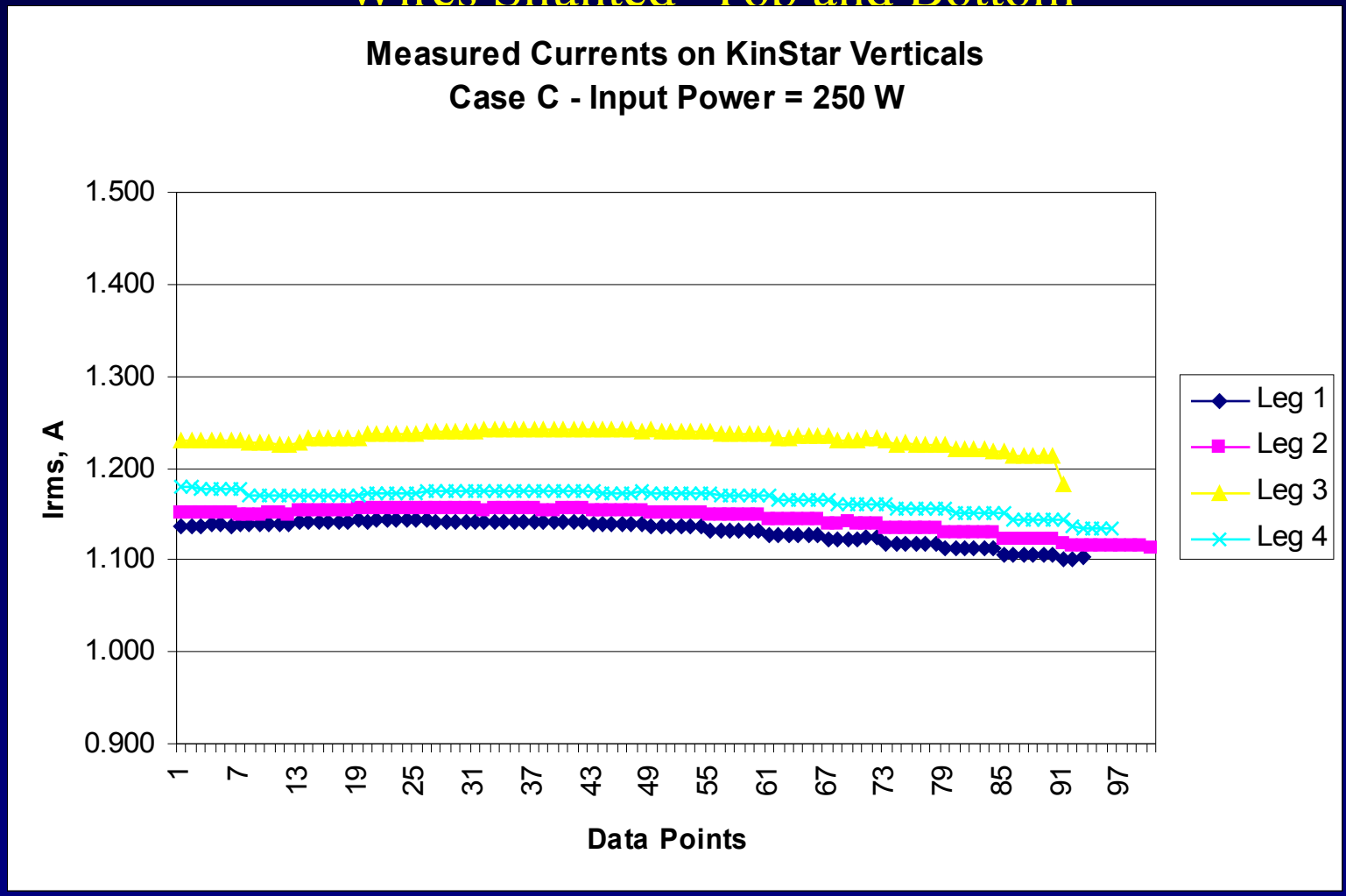
Case B: NEC Predicted Currents

Wires Shunted – Bottom Only



Case C: Measured Currents

Wires Shunted -Top and Bottom



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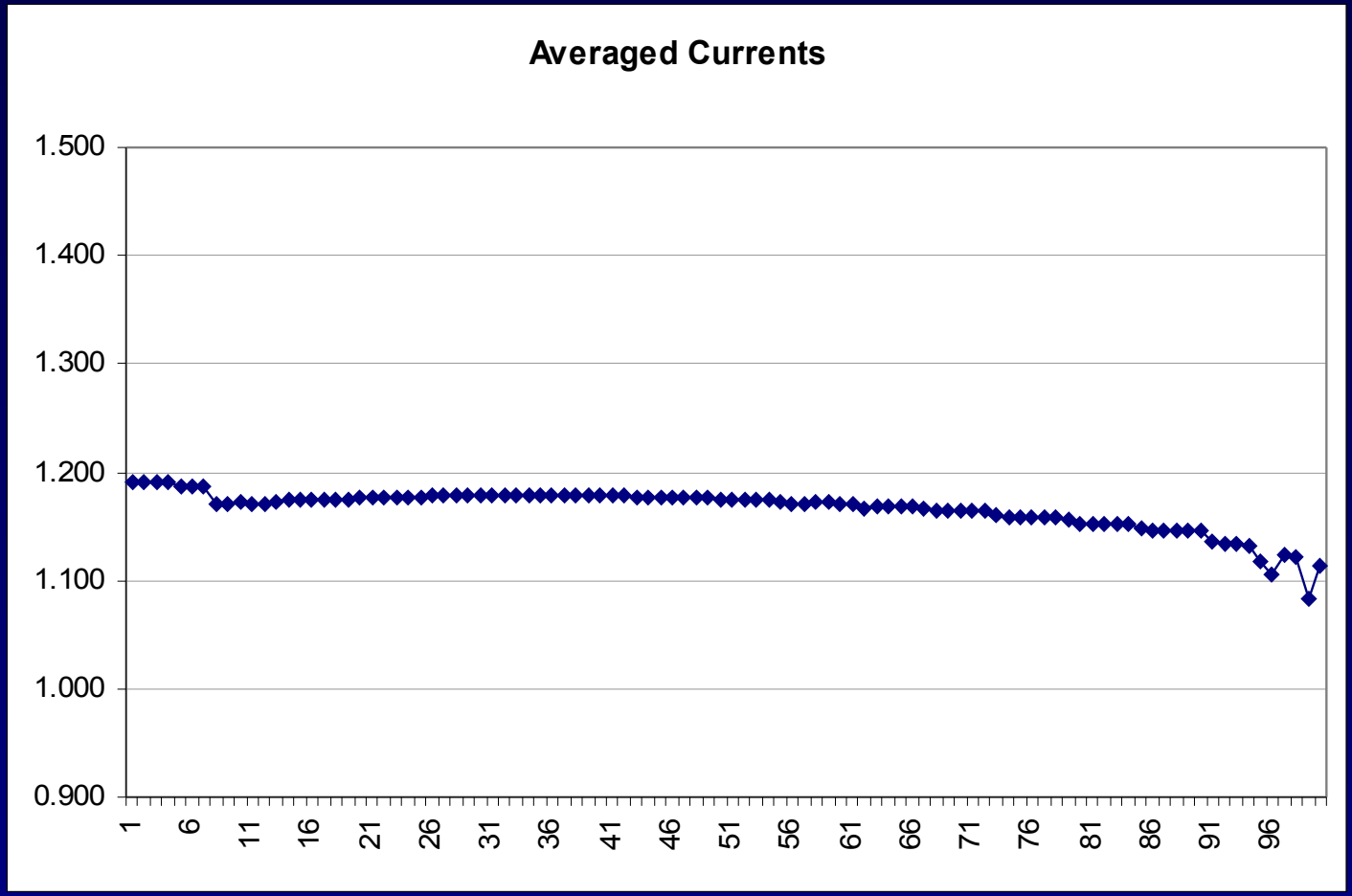
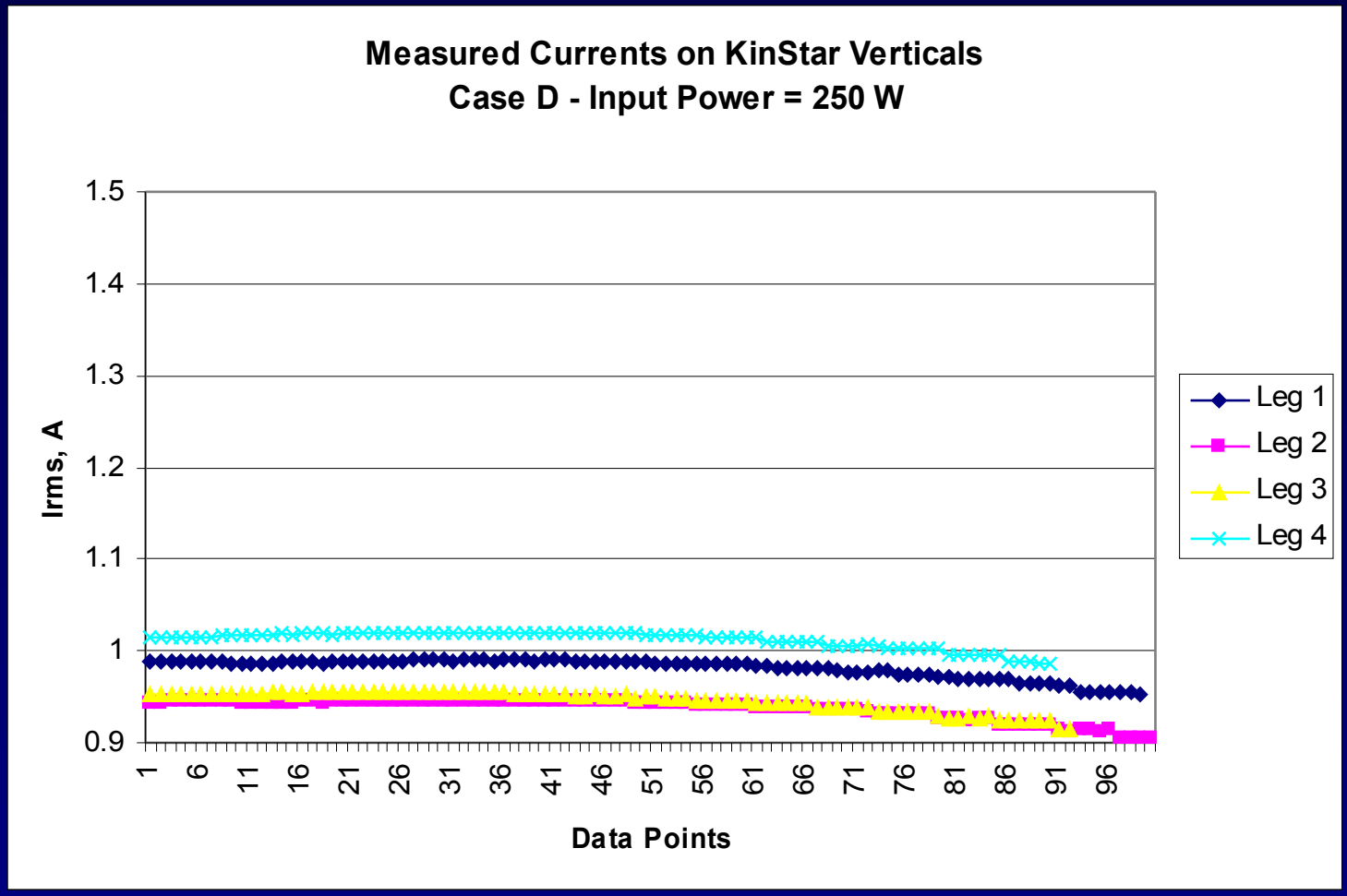


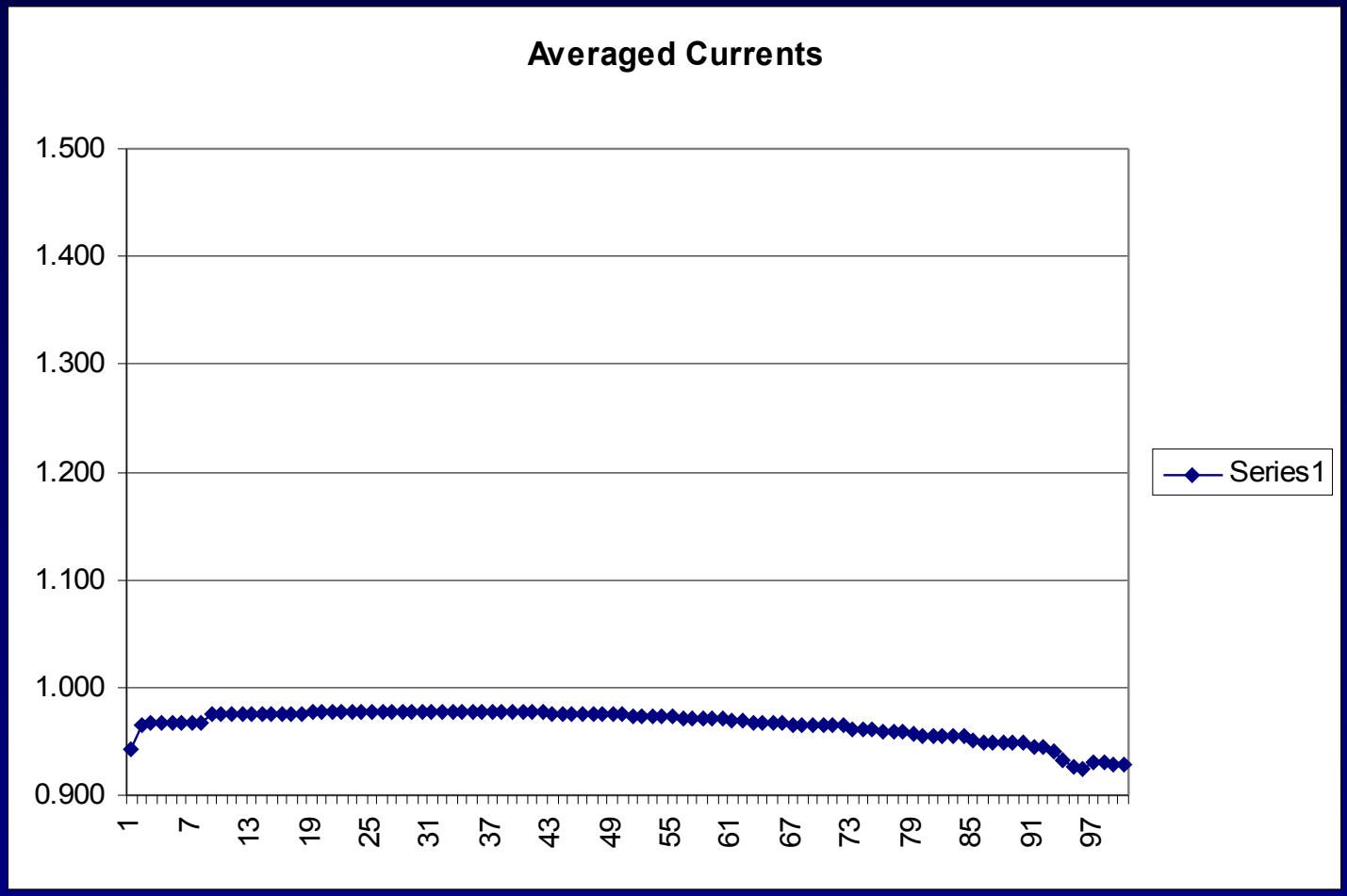
Case D: Measured Currents

Wires Shunted -Top and Bottom



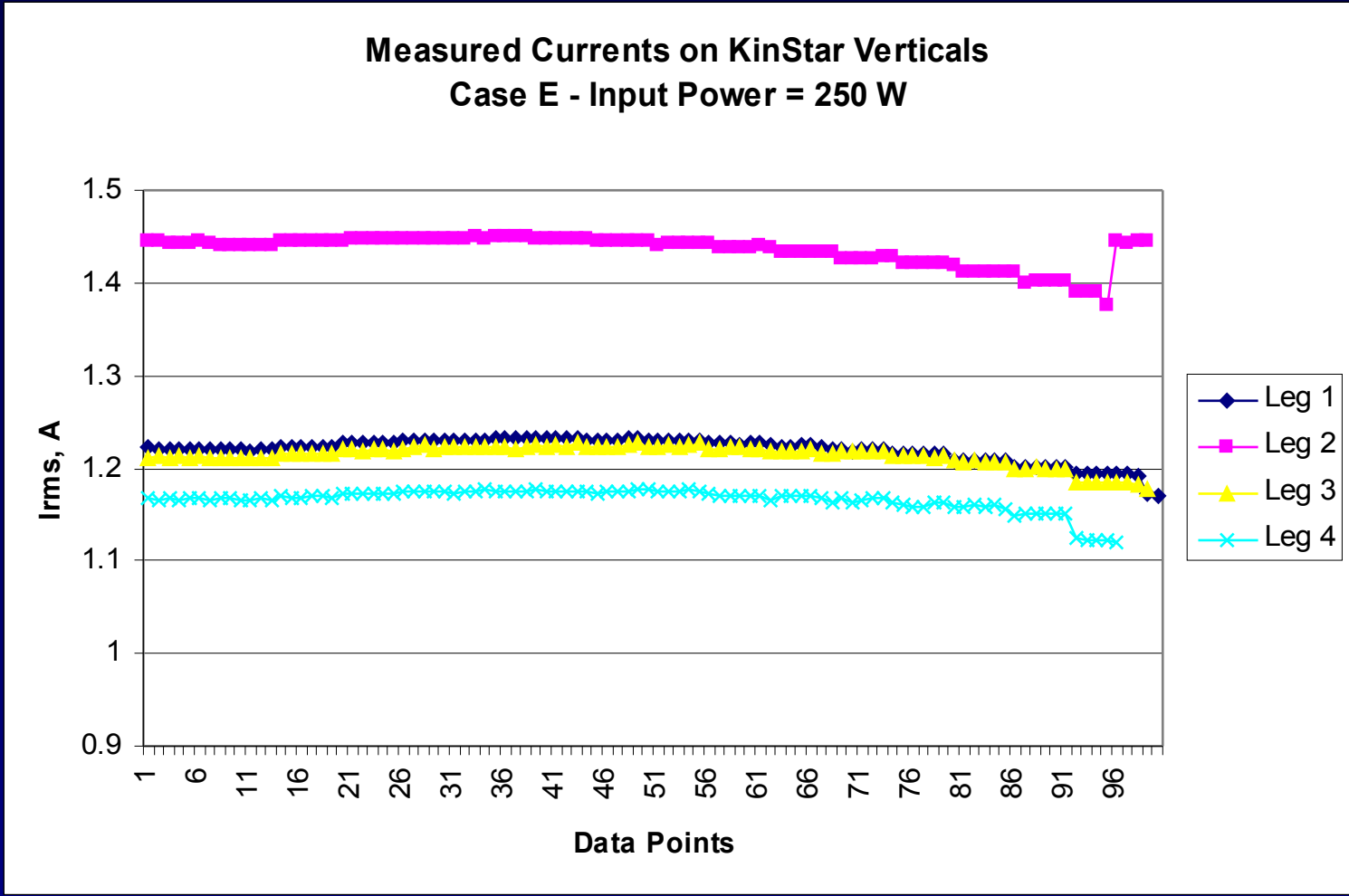
Case D: Averaged Currents

Wires Shunted -Top and Bottom



Case E: Measured Currents

Individual Wires – Transmission Line Feed



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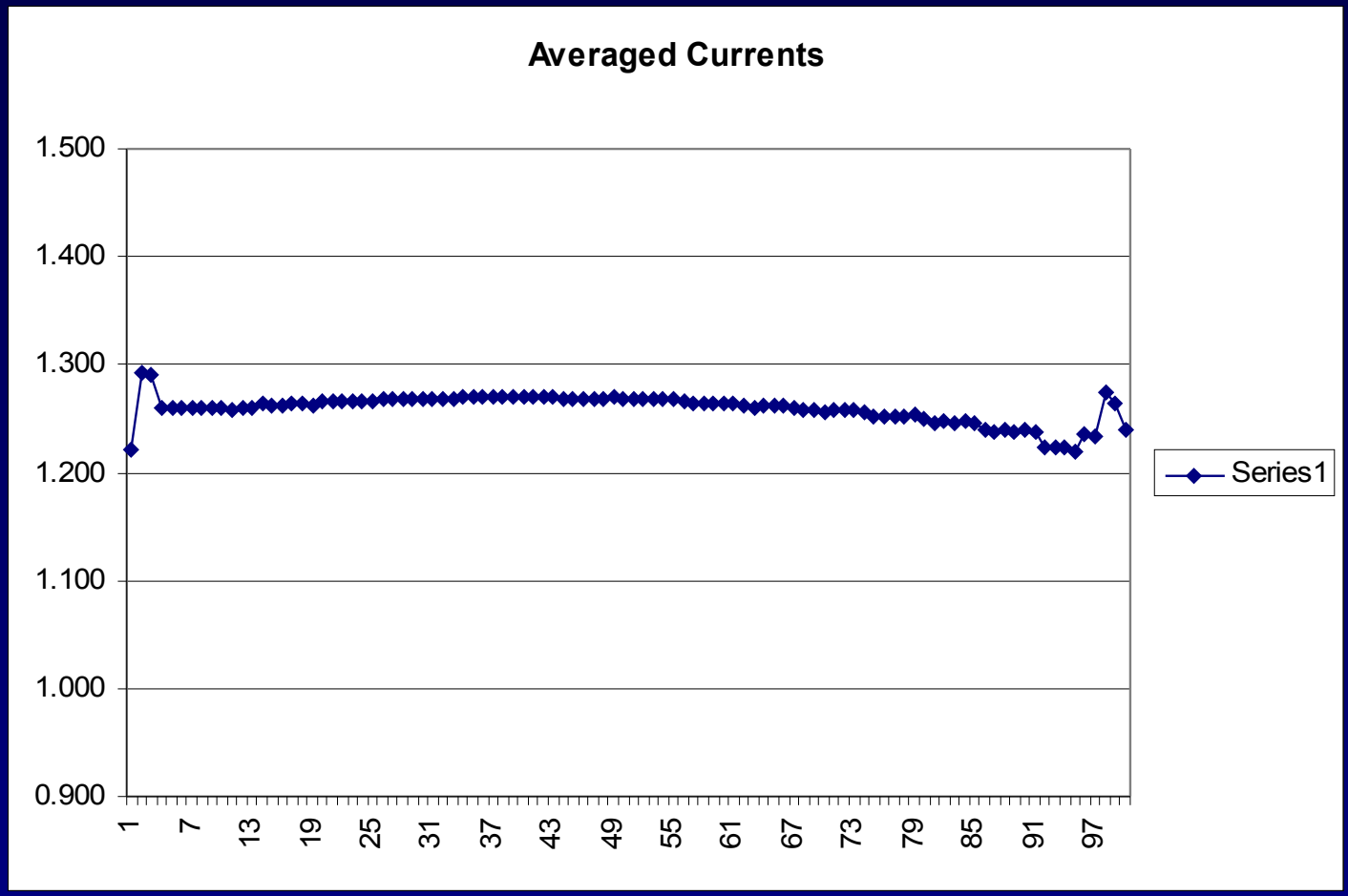


Causes of Observed Deviation of Measured Currents

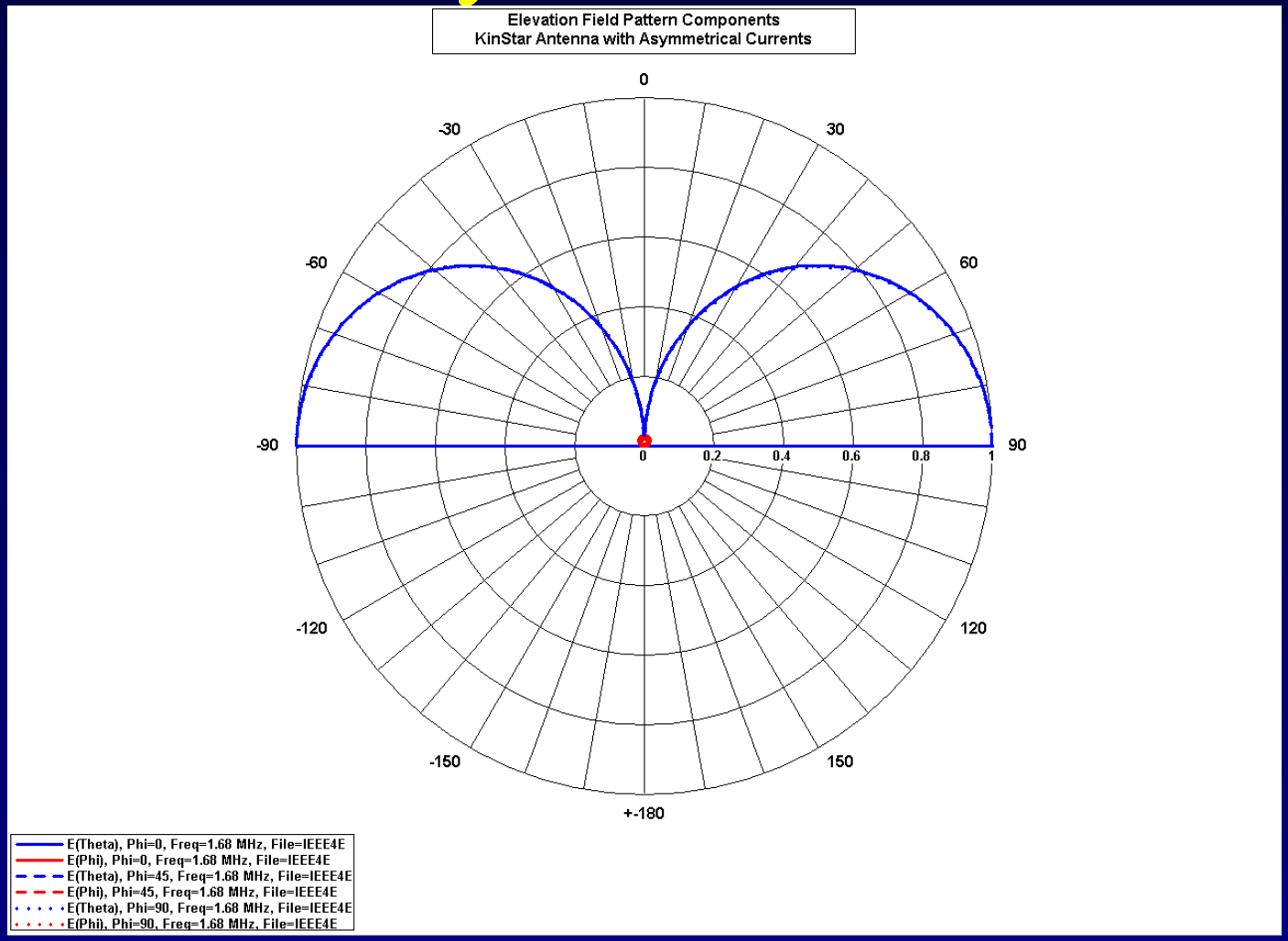
- Construction tolerances

Wire	Deviation from design spacing (Feet)
1	1.1
2	0.8
3	0.3
4	1.1

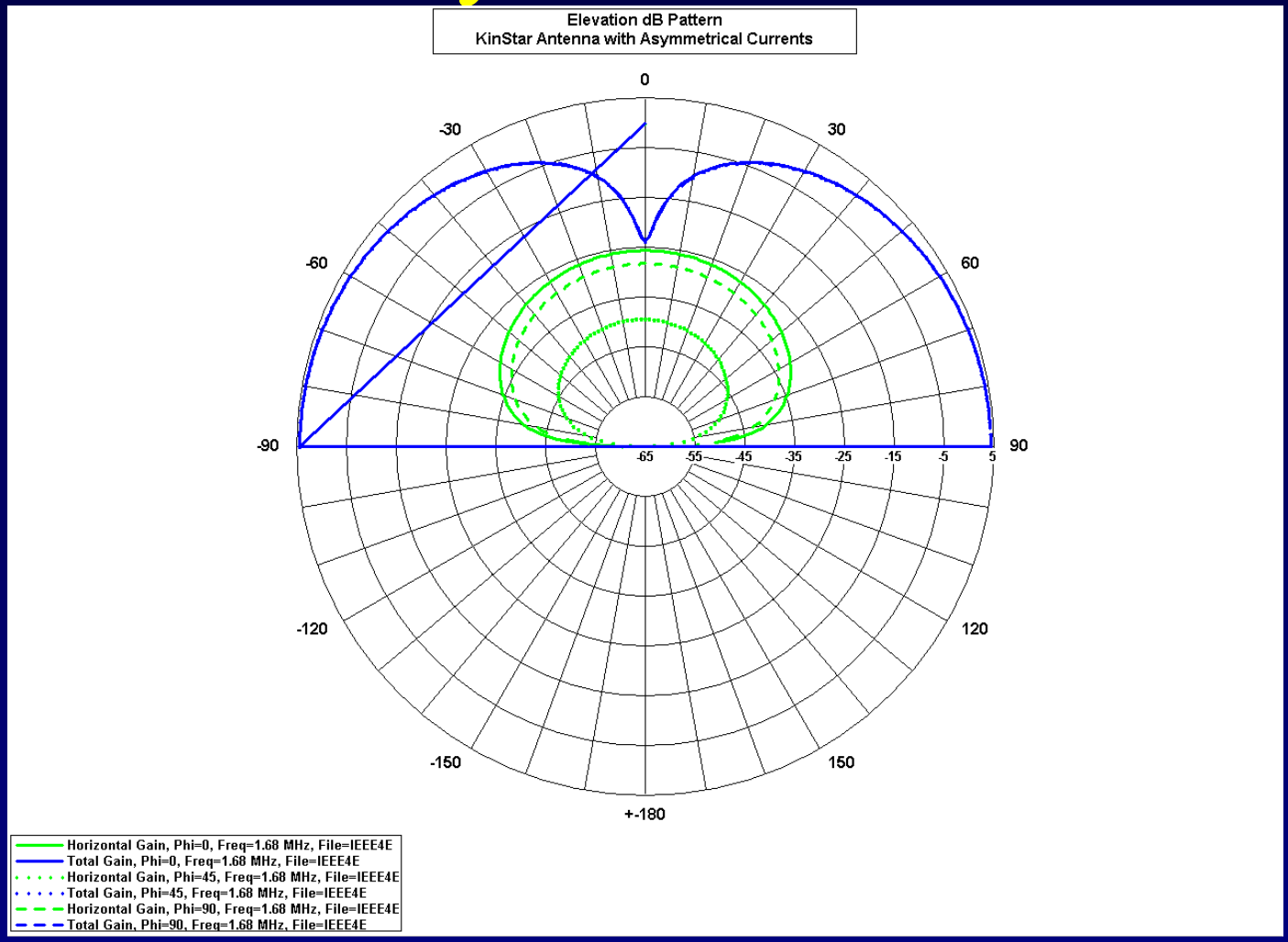
- Site grade not level

Wire	Average Elevation (Feet)	Difference from Center (Feet)
Center	100	
1	99.33	-0.67
2	101.43	1.43
3	99.31	-0.69
4	98.79	-1.21

Effect of Asymmetrical Currents



Effect of Asymmetrical Currents

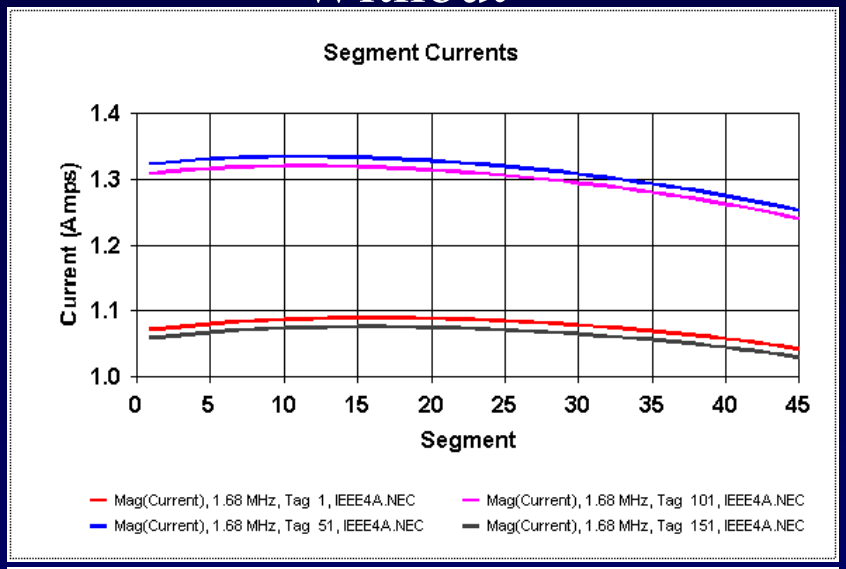


Current Variation Among Elements

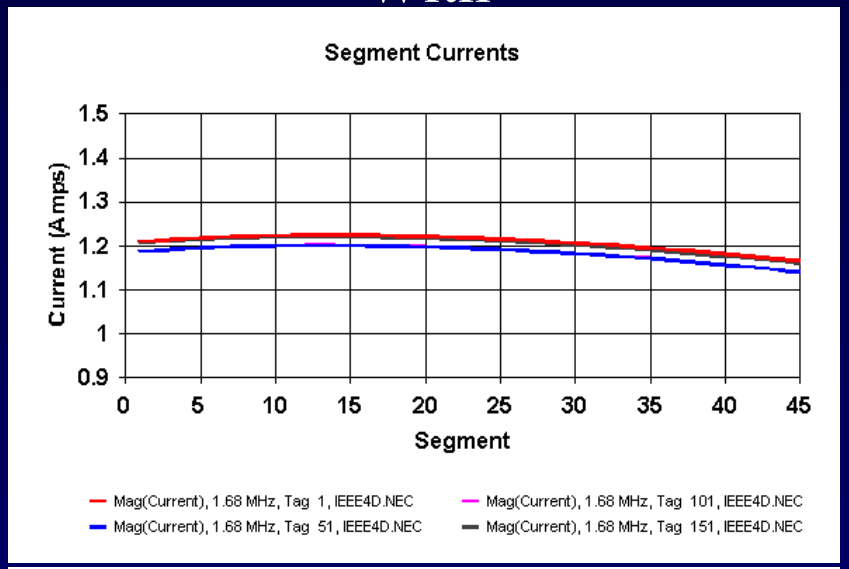
- Caused by deviations from symmetrical design, can be a result of misplacement of wires, or variations in grade level under the antenna.
- Not expected to significantly affect azimuthal radiation pattern.
- May cause asymmetrical currents on top loading wires, resulting in some horizontally-polarized radiation (-25 to 30 dB).
- Possible solution by shunting together the top ends of the vertical radiating wires.

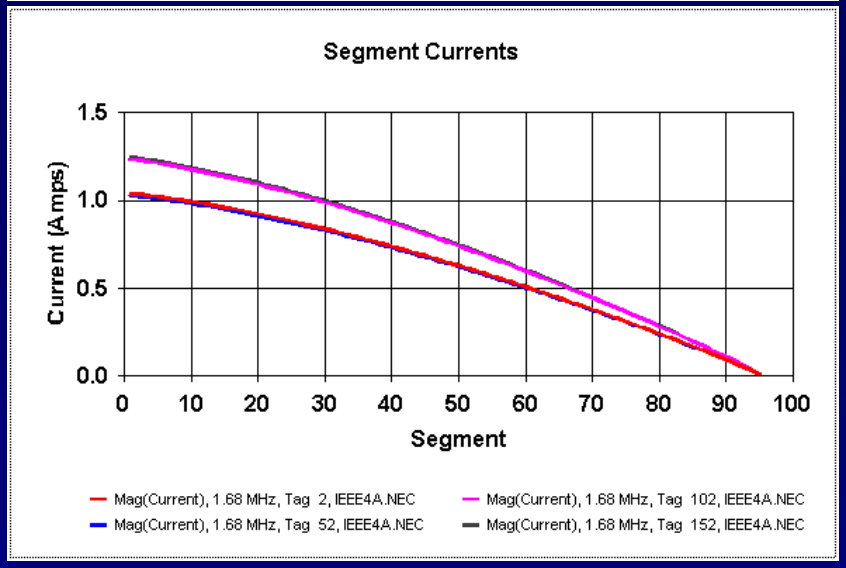
Improvement Due to Top Shunting

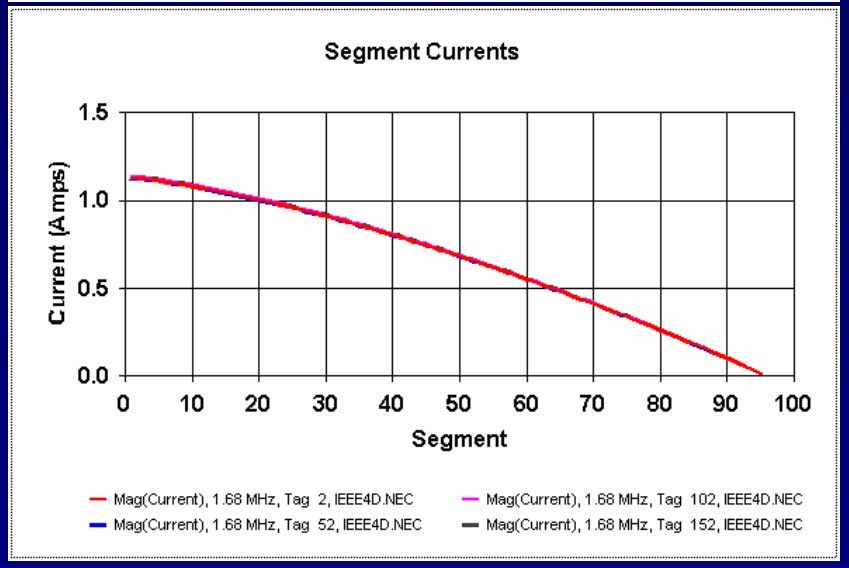
Without



With

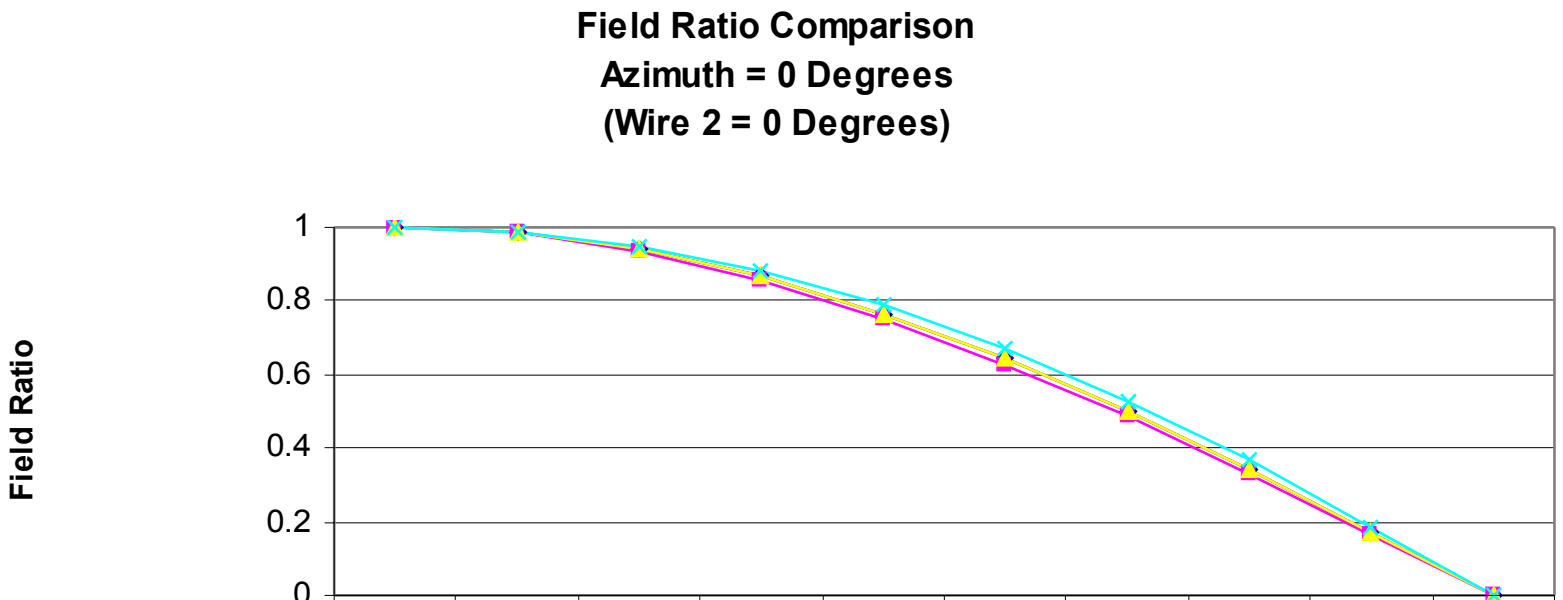






KinStar Elevation Field

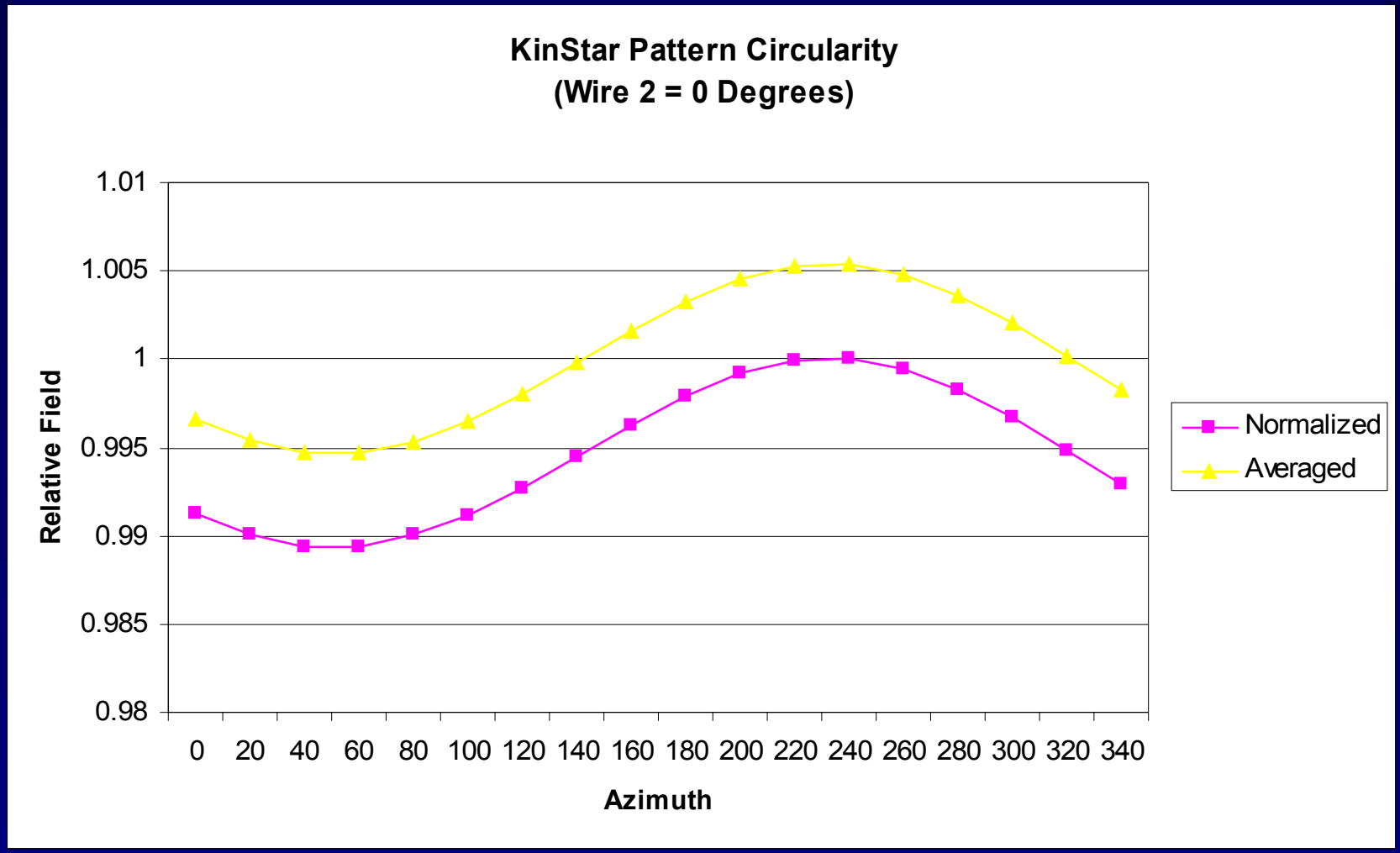
calculated using Case A unequal currents



	0	10	20	30	40	50	60	70	80	90
KinStar Field	1	0.9848	0.9397	0.8660	0.7660	0.6428	0.5000	0.3420	0.1736	0
FCC Formula	1	0.9840	0.9350	0.8580	0.7530	0.6280	0.4850	0.3300	0.1670	0
Sin(Theta)	1	0.9848	0.9397	0.8660	0.7660	0.6428	0.5000	0.3420	0.1736	0
NEC	1	0.9871	0.9481	0.8827	0.7905	0.6720	0.5291	0.3655	0.1868	0

KinStar Azimuth Field

calculated using Case A unequal currents



Conclusions

- Actual current distribution matches NEC prediction.
- Unequal currents can result from environmental and construction effects.
- Unequal currents can result in small amounts of undesired horizontally-polarized radiation at high angles.
- Shunting the vertical wires together at the top can reduce the variation in the wire currents, significantly reducing the potential for undesired horizontally polarized radiation (~6dB reduction).