

### 73.1690 Exhibit to Modification of License Application

By this application we notify of a change in omnidirectional antenna with one with a different number of antenna bays, with a slight reduction of the height of the antenna radiation center and no change in effective radiated power ("ERP") in accordance with 73.1690(c)(1)

We are further reporting a change in transmitter operating power ("TPO") from the authorized value.

The new antenna is an ERI, Model: "SHPXA-16BC-HW-SP-2" -- 16 bays @ 0.50  $\lambda$ , mounted at 62.5 meters center of radiation above ground level. The prior antenna was mounted 65.0 m above ground level.

The analog transmitter operating power (TPO) for each station is:

Station: KBKS-FM (FM; Fac ID 27020; 16.656 kW

Station: KZOK-FM (FM; Fac ID 20357; 17.180 kW

Station: KJAQ(FM) (FM; Fac ID 1091; 12.582 kW

### Beam Tilt

The additional of electrical beam tilt, as well as first and second null fill reduces the gain of the array at all frequencies in use. Please see attached ERI antenna document for full details.

Summary of Beam Tilt ERP values:

Station: KBKS-FM (FM; Fac ID 27020; Max Power: 73.0. At Horizon: 68.0 kW

Station: KZOK-FM (FM; Fac ID 20357; Max Power: 73.0. At Horizon: 68.3 kW

Station: KJAQ(FM) (FM; Fac ID 1091; Max Power: 52.0. At Horizon: 49.0 kW

### RF Statement:

Each stations combined analog and digital power.

Status	Calls	Channel	Analog + Digital kW
LIC	KBKS-FM	291C	73.7
LIC	KJAQ(FM)	243C	NC

Status	Calls	Channel	Analog + Digital kW
CP	KJAQ-CP	243C	70.7
LIC	KNUC(FM)	255C	68.7
LIC	KQMV(FM)	223C	60.6
LIC	KSWD(FM)	231C	78.8
LIC	KZOK-FM	273C	78.8
		<b>Total kW=</b>	<b>431.3</b>

The facilities were evaluated in terms of potential radio frequency radiation exposure at ground level in accordance with OET Bulletin No. 65, "Evaluating Compliance With FCC-Specified Guidelines for Human Exposure to Radio frequency Radiation."

The new antenna system is an ERI Axiom SHPXA "Roto-Tiller", 16- element; half-wave spaced antenna mounted 62.5 meters above ground. For purposes of this analysis the FM Model web page has been set to calculate values for this type of antenna element array, operated with a combined effective radiated power of 431.3 Kilowatts in both the horizontal and vertical planes. At 2 meters above the surface, at 318 meters from the base of the tower, this proposal will contribute worst case, 13.3 microwatts per square centimeter, or 1.33 percent of the allowable ANSI limit for controlled exposure, and 6.65 percent of the allowable limit for uncontrolled exposure. It is therefore believed that this proposal is in compliance with OET Bulletin Number 65 as required by the Federal Communications Commission.

Further, the applicant will see that signs are posted in the vicinity of the tower, warning of potential radio frequency hazards at the site. The site itself is restricted from public access. The applicant will cooperate with other users of the tower to reduce power of the facility, or discontinue operation, as necessary to limit human exposure to levels less than specified by the Federal Communications Commission should anyone be required to climb the tower for maintenance or inspection.

# ERI Antenna Document

# Electronics Research, Inc.

## ERI Technical Proposal 16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System (Antenna system modified to include electrical beam tilt and first and second null fill)

**West Tiger Mountain II**  
Seattle, Washington

ERI Technical Proposal: 20190325-063  
Date Prepared: March 30, 2019

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American Tower Corporation

16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System  
(Antenna system modified to include electrical beam tilt and first and second null fill)

## Contents

<b>Executive Summary .....</b>	<b>3</b>
<b>AXIOM® SHPXA Series Master FM Antennas .....</b>	<b>4</b>
FEATURES .....	4
Electrical Specifications .....	5
Mechanical Specifications .....	5
<b>Preliminary Power Analysis at Maximum HD Radio...</b>	<b>15</b>
<b>Lambda™ Optimized FM Mounting System.....</b>	<b>20</b>

American Tower Corporation

**16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System  
(Antenna system modified to include electrical beam tilt and first and second null fill)**

## Executive Summary

This revises the proposal provided previously (ERI Proposal 20190227-777) and has added optional electrical beam tilt and first and second null fill to the 16-bay AXIOM® Master FM Antenna proposed to American Tower. This proposal also includes the Lambda Optimized FM Mounting System included in the previous proposal. The antenna location and desired area of coverage requires the electrical beam tilt and first and second null for optimum performance. Adding these elevation pattern modifications requires changes to more than one part of the system, these include:

1. The standard AXIOM feed design will require custom modifications to the standard power distribution within each half of the array. This proposal includes those costs.
2. The phasing between the Upper 8-Bays of the array and the Lower 8-bays of the array will need to be modified. The proposal includes the 6-1/8-inch line section a field service to perform those changes.
3. The existing patch panel/power divider will require it hybrid be replaced with a new in-phase power with an asymmetrical power split. This proposal includes the material and field service to perform these modifications.

The 16 bay AXIOM Master FM Antenna proposed has higher gain than the ERI Model 1184-8CP-2 Master FM Antenna it is replacing. The additional of electrical beam tilt, and first and second null fill reduces the gain of the array at all frequencies in use. The addition of asymmetrical power division between the upper and lower halves the array significantly increases the amount of power fed to the lower half of the array, versus the upper half. The power budget provided includes the reduction in antenna gain to provide the total analog and digital power level at the combiner output and patch panel input and also includes the asymmetrical power distribution at the patch panel outputs, on each transmission line and at the antenna inputs.

The power budget included in this document, beginning on page 15 is calculated with KJAQ operating at its increased analog ERP of 70 kW and all of the stations in the system operating at their Maximum Allowed HD Power Levels, based on information obtained from the Nautel on-line HD Power Calculator. The combined power output for the analog and HD combined power at the combiner output is 102.029 kW (11,502 volts) which is well below the maximum power voltage handling capability of the 6-1/8-inch rigid line from the combiner output to the patch panel and less than the 6-1/8-inch patch panel power handling capability.

The potential to add other stations to this system depends on the actual operating HD power levels for the current tenants and the effective analog and digital power levels for any new facilities that may wish to relocate to this site. Please contact ERI with the details of any planned additions to the system or changes to HD power levels so that a revised power budget can be provided.

If you have questions on this material please contact Bill Harland at +1 (812) 925-6000, Ext. 214, or at [bharland@eriinc.com](mailto:bharland@eriinc.com).

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16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System  
(Antenna system modified to include electrical beam tilt and first and second null fill)

## AXIOM® SHPXA Series Master FM Antennas

ERI offers 4, 8, 12, and 16-bay versions of its AXIOM® master FM antenna. The AXIOM is a specially designed antenna system which provides high input power handling capability and can provide service as an auxiliary master FM antenna for systems that are limited to a bandwidth requirement of up to 18 MHz of the FM Band (88 MHz to 108 MHz). The antenna can be designed with a single RF input or can be configured as separate upper and lower antennas for higher power handling capability and redundancy.

### FEATURES

- Low VSWR
- Internal feed
- Fully pressurized
- Series fed radiating elements
- Circular polarization
- Welded feed connections
- Superior VSWR band width
- High input power capacity
- Custom modifications are available
- Corrosion resistant construction
- Modular construction facilitates easy installation and repair
- Minimal weather related VSWR problems
- Beam tilt and/or null fill available
- Half-wave spacing between elements available
- Rugged brass construction
- Stainless steel support brackets and hardware
- Radomes or deicing heaters not normally required for radial ice less than ½-inch
- Radomes or deicing heaters are available
- Custom designed antenna supports; poles or Lambda™ tower sections are also available from ERI

ERI antennas are unchallenged in quality and dependability. ERI is the only manufacturer to use large diameter outer conductors and a completely enclosed, pressurized, internal series feed system. The result is a simple and reliable method of coupling power to the elements. Unlike competing designs, ERI series fed antennas do not require a troublesome secondary current loop for element excitation with all the resulting disadvantages. All ERI antennas include brackets for mounting on leg, pole, or face mounting (up to 42-inch uniform cross section tower), brackets for other mounting configurations are optionally



AXIOM™ SHPXA-16BC-HW-SP Broad Band FM Antenna  
owned by American Tower in Miami, Florida

**American Tower Corporation**

**16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System  
(Antenna system modified to include electrical beam tilt and first and second null fill)**

available. The ROTOTILLER® series FM antenna's unique design consists of two series fed, bent dipole elements which form a space phased, circularly polarized radiator. The antenna's configuration and the large diameter of the radiating elements contribute to the excellent bandwidth of the antenna system, and also inhibits corona discharge.

The horizontal plane azimuth pattern of the SHPX series antenna is omnidirectional within ±2 dB when the antenna is pole or Lambda™ optimized FM mounting section mounted atop a tower. Side mounting the antenna on a typical tower structure will affect the azimuth pattern. ERI offers a pattern measurement service to assist in determining the effect of the mounting structure on the antenna's pattern. Using ERI's pattern optimization service the pattern's circularity may be improved through the addition of parasitically excited elements.

Utilize the ERI advantage, combine an ERI antenna with an ERI Lambda™ Mounting Structure, Pattern Measurement and Installation. Assure yourself of the best antenna/tower interaction. ERI's Pattern Measurement service will provide the crucial answers concerning the relationship between the antenna mounting orientation and antenna pattern. Lambda Sections are designed to achieve optimum antenna performance while reducing weight and wind loads. Only ERI can offer you an antenna/tower/installation package that will achieve your highest expectations in a demanding FM radio market.

**Electrical Specifications**

Frequency Range:	Specified 18 MHz of the FM Band (88 to 108 MHz)
RF Input Power Rating:	See chart below for standard configuration input power ratings Available with dual inputs for higher power handling capability.
VSWR:	1.25:1, maximum with field tuning
Element Type:	SHPX Series ROTOTILLER™
Azimuth Pattern Circularity:	+/-2 dB, in free space
Polarization:	Circular (Clockwise)
Axial Ratio:	Less than 3 dB in free space

<b>Model</b>	<b>RF Input Flange</b>	<b>Power Handling</b>
SHPXA-4BC-HW-SP	Single, 4-1/16-inch EIA, Female	64 kW
SHPXA-8BC-HW-SP	Single, 6-1/8-inch EIA, Female	120 kW
SHPXA-12BC-HW-SP	Single, 6-1/8-inch EIA, Female	120 kW
SHPXA-16BC-HW-SP	Single, 6-1/8-inch EIA, Female	120 kW

<b>Gain</b>	<b>4-Bay</b>		<b>8-Bay</b>		<b>12-Bay</b>		<b>16-Bay</b>	
	<b>Numeric</b>	<b>dB</b>	<b>Numeric</b>	<b>dB</b>	<b>Numeric</b>	<b>dB</b>	<b>Numeric</b>	<b>dB</b>
88.1 MHz	1.179	0.715	2.247	3.516	3.318	5.209	4.390	6.425
98.1 MHz	1.308	1.166	2.522	4.017	3.736	5.724	4.951	6.947
107.9 MHz	1.394	1.443	2.703	4.318	4.012	6.034	5.322	7.261

**Mechanical Specifications**

<b>Model</b>	<b>Antenna Length</b>		<b>Aperture recommended</b>	
	<b>Feet</b>	<b>Meters</b>	<b>Feet</b>	<b>Meters</b>
SHPXA-4BC-HW-SP	19.3	5.88	29.3	8.93
SHPXA-8BC-HW-SP	39.3	11.98	49.3	15.03
SHPXA-12BC-HW-SP	59.8	18.23	69.8	21.28
SHPXA-16BC-HW-SP	79.3	24.17	89.3	27.22

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16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System  
 (Antenna system modified to include electrical beam tilt and first and second null fill)

### Mechanical Specifications

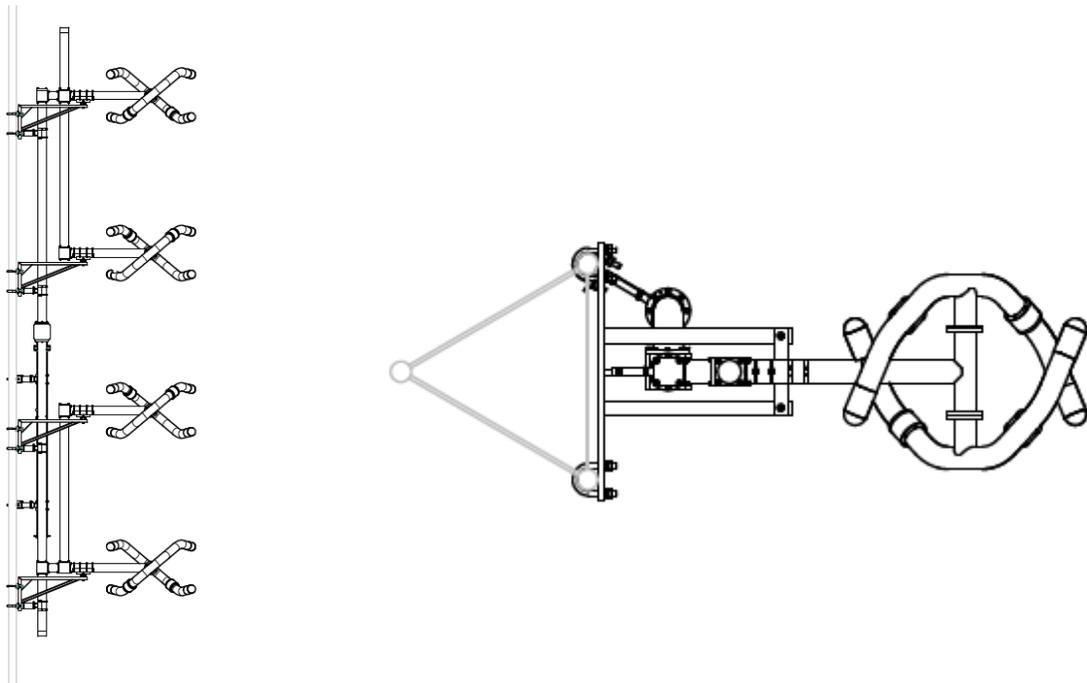
Model	Antenna Only				Antenna with Radomes			
	Weight		CaAc		Weight		CaAc	
	lbm	kg	sq ft	sq mtr	lbm	kg	sq ft	sq mtr
SHPXA-4BC-HW-SP	675	306.2	19.3	1.79	875	396.9	23.8	2.21
SHPXA-8BC-HW-SP	1166	528.9	57.6	5.35	1566	710.3	79.6	7.40
SHPXA-12BC-HW-SP	1661	753.4	85.9	7.98	2261	1025.6	125.3	11.64
SHPXA-16BC-HW-SP	2156	978.0	114.2	10.61	2956	1340.8	170.9	15.88

Model	Antenna Only with 1/2-inch radial ice				Antenna with Radomes with 1/2-inch radial ice			
	Weight		CaAc		Weight		CaAc	
	lbm	kg	sq ft	sq mtr	lbm	kg	sq ft	sq mtr
SHPXA-4BC-HW-SP	1000	453.6	23.8	2.21	1500	680.4	41.1	3.82
SHPXA-8BC-HW-SP	1855	841.4	73.5	6.83	2855	1,295.0	108.9	10.11
SHPXA-12BC-HW-SP	2685	1217.9	109.9	10.21	4185	1,898.3	162.9	15.13
SHPXA-16BC-HW-SP	3515	1594.4	146.2	13.58	5515	2,501.6	216.9	20.15

**Notes:**

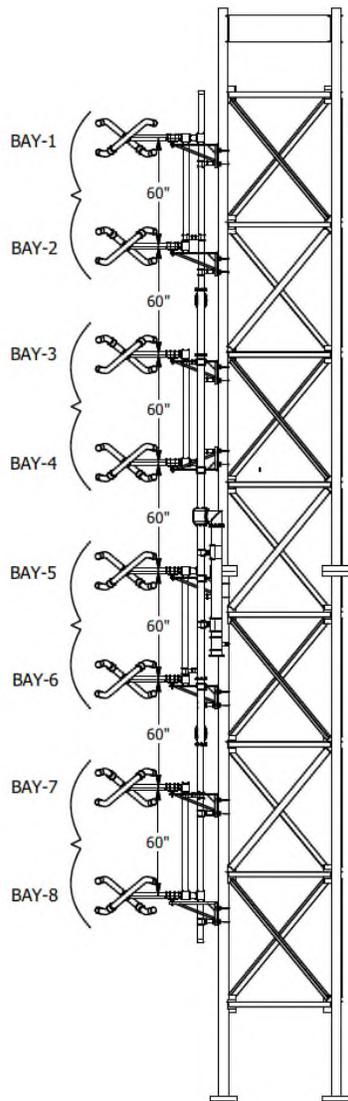
- 1) All loads calculated in accordance with the ANSI/TIA-222 standard.
- 2) Listed antenna weights and effective wind areas are based upon 'typical' configurations. Final design loads will vary for specific projects and should be verified by an ERI representative.
- 3) Loading includes antenna radiating elements, interbay feed, and standard leg mounting brackets. Special mounting bracket loads for face-mounted and/or pole standoff mounted systems are NOT included.
- 4) No wind shielding taken into account for supporting structure.



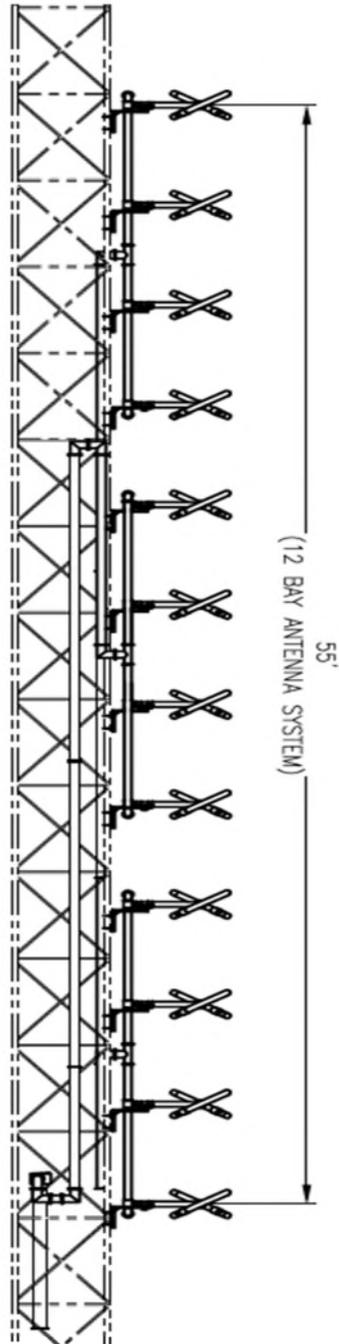
Model SHPXA-4BC-HW-SP 4 Bay AXIOM Master FM Antenna

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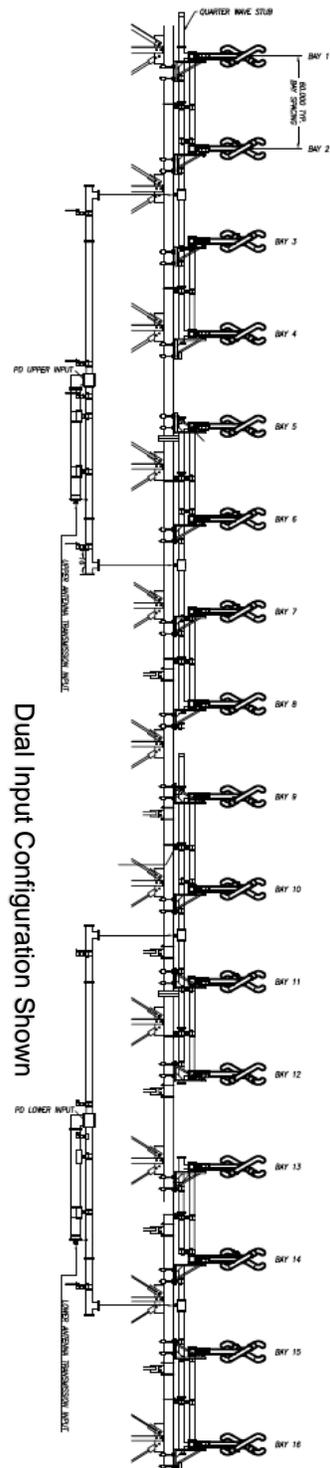
**16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System  
(Antenna system modified to include electrical beam tilt and first and second null fill)**



**Model SHPXA-8BC-HW-SP 8 Bay  
AXIOM Master FM Antenna**



**Model SHPXA-12BC-HW-SP 12  
Bay AXIOM Master FM Antenna**



**Model SHPXA-16BC-HW-SP 16  
Bay AXIOM Master FM Antenna  
(Dual input version)**

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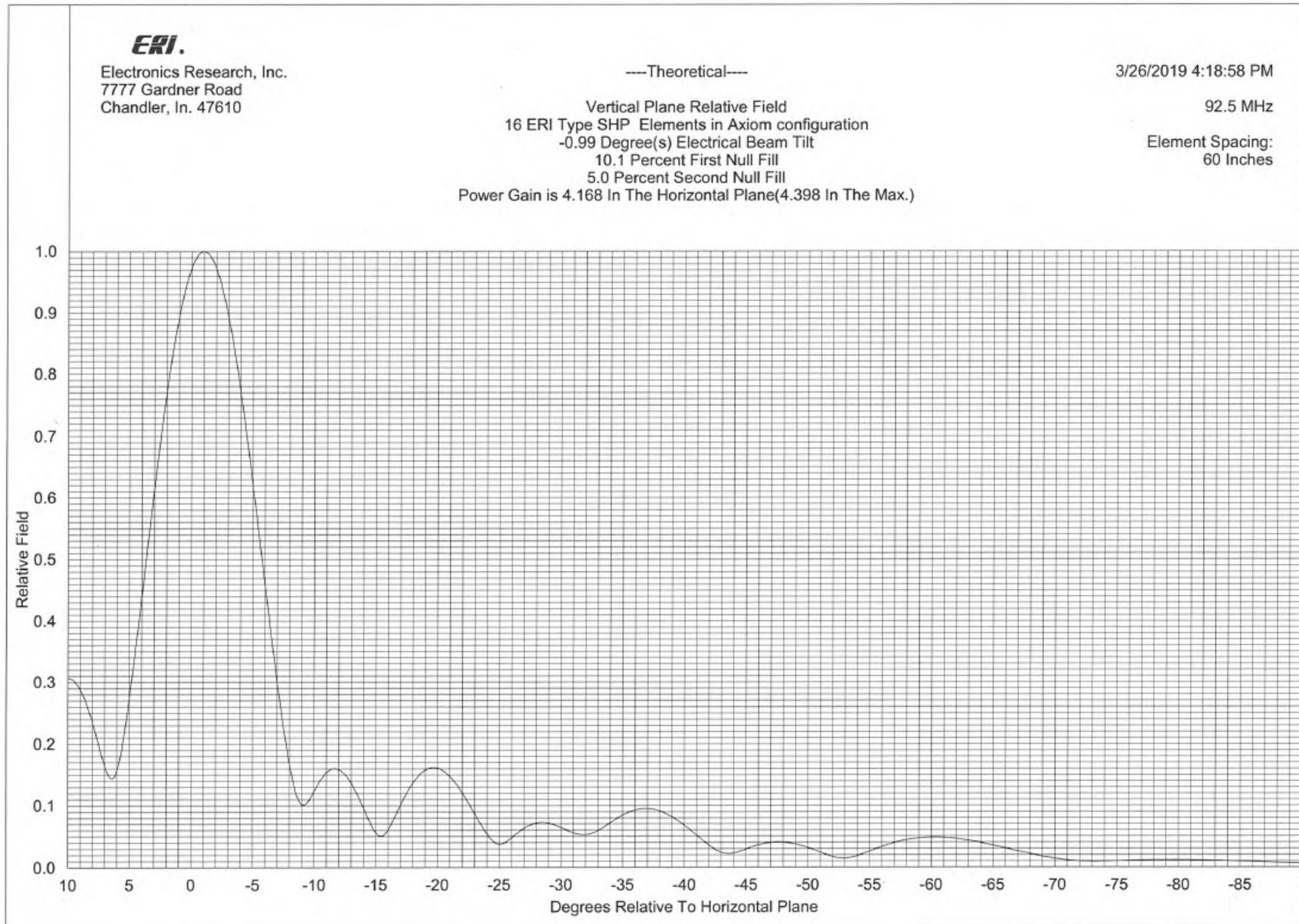
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AXIOM Master FM Antenna at ERI's manufacturing facility in Chandler, Indiana, USA.

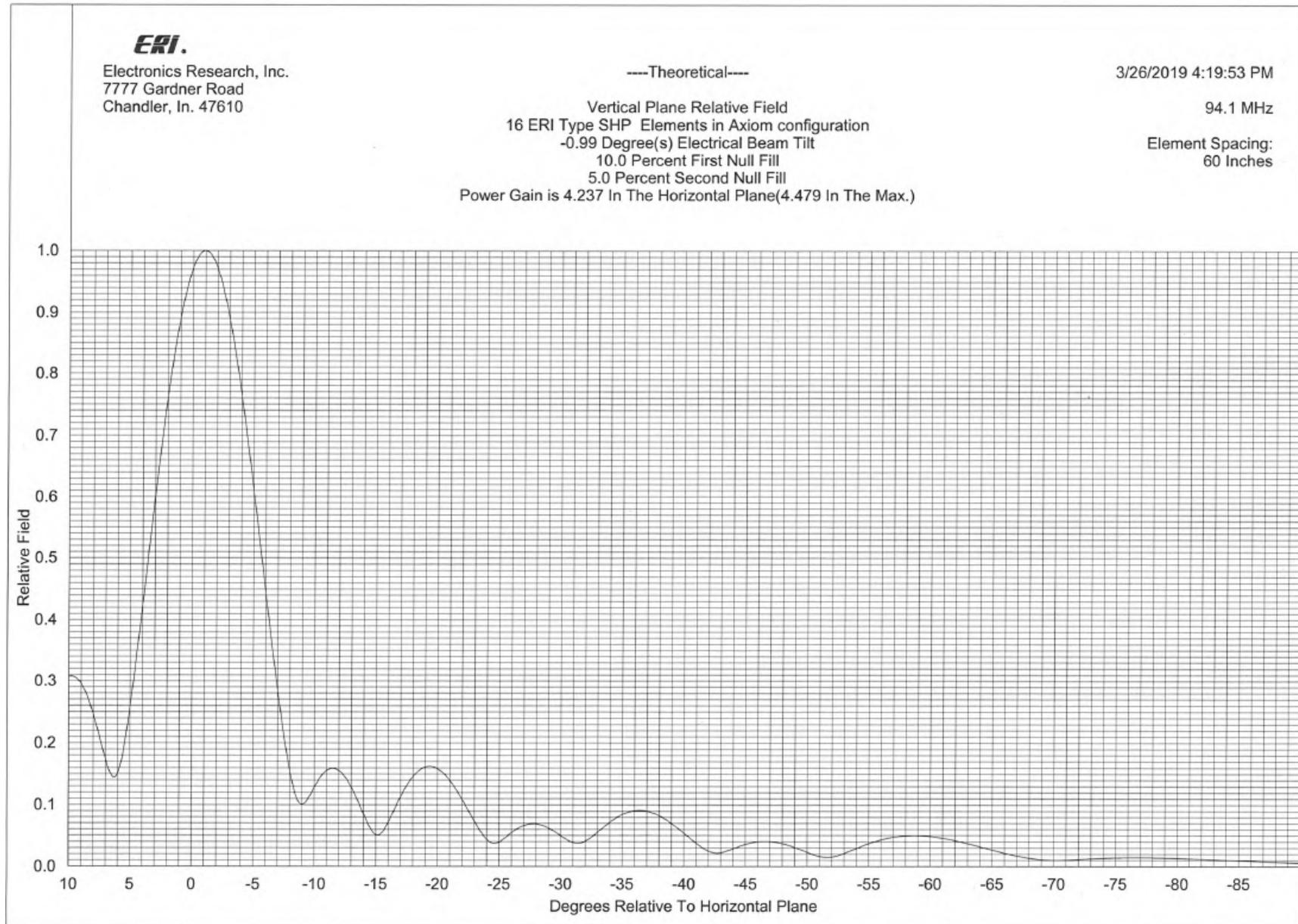
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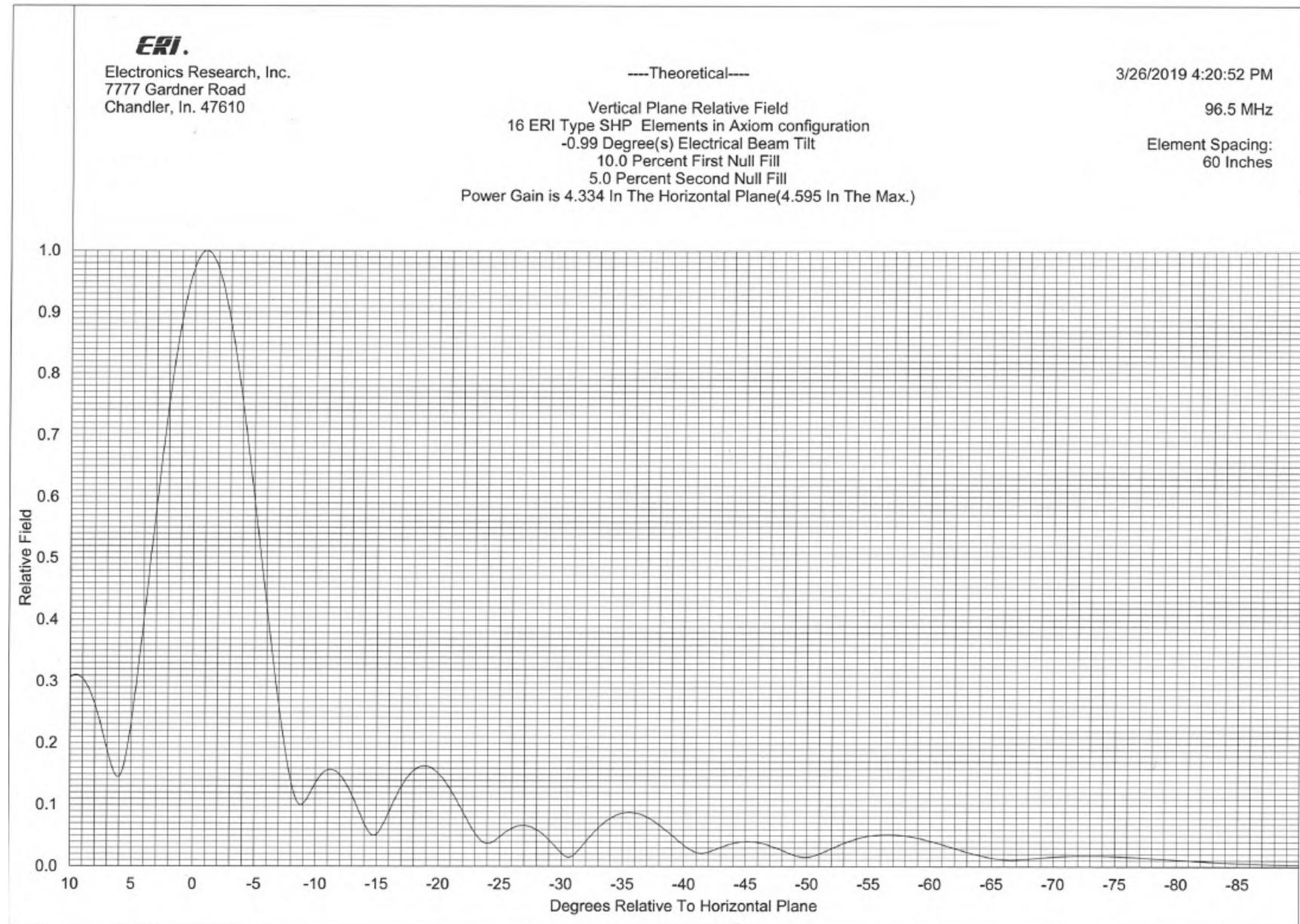
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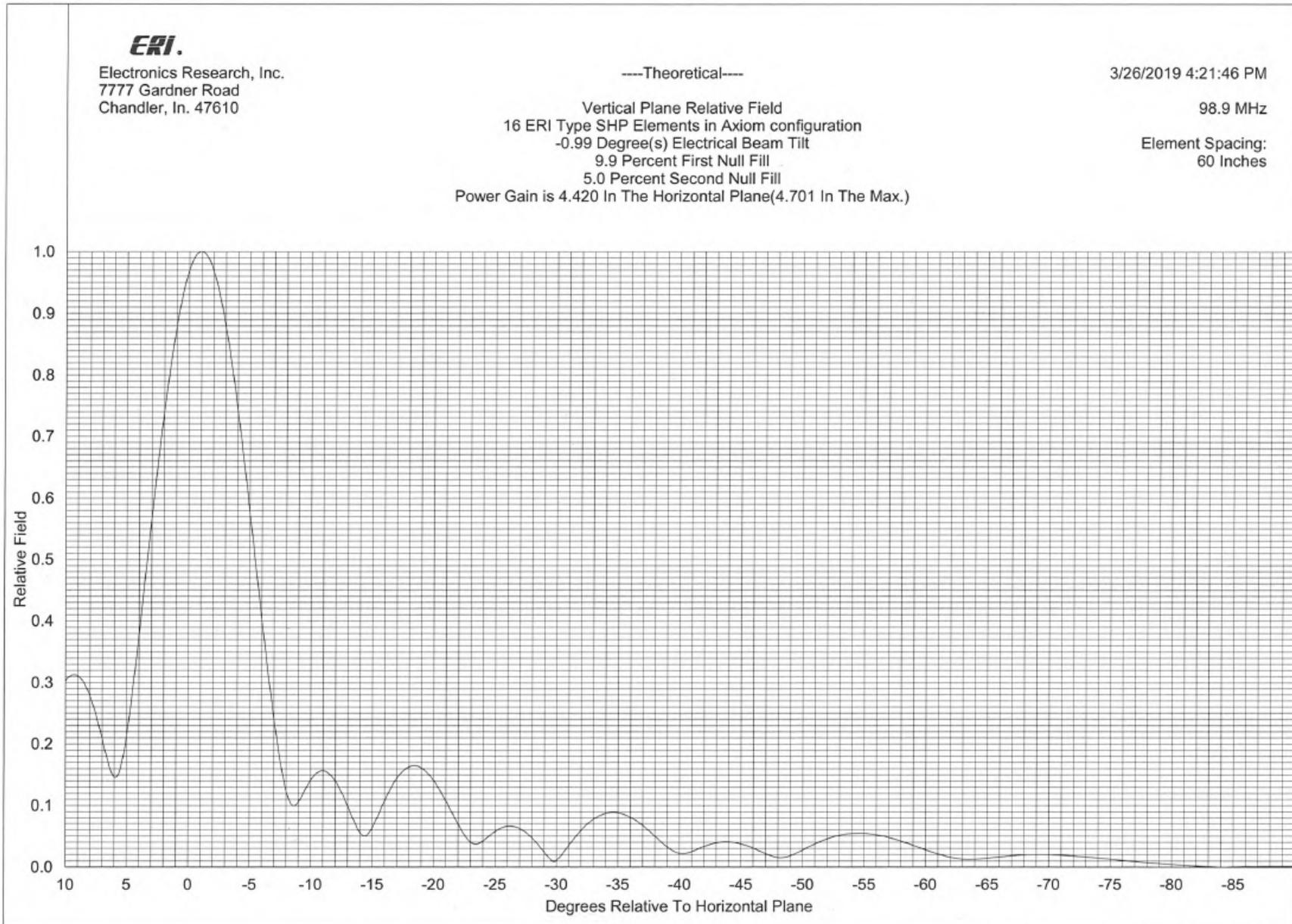
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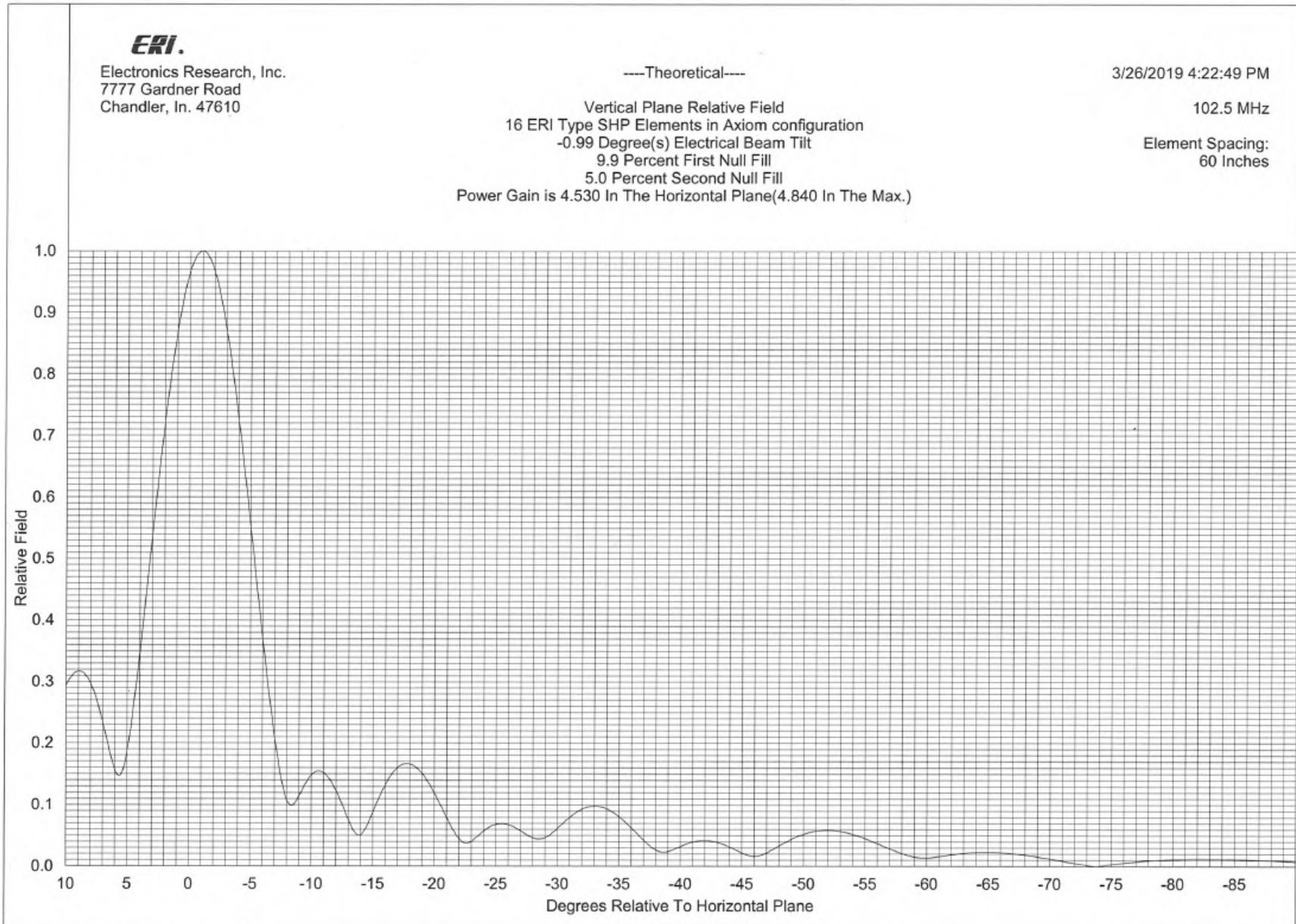
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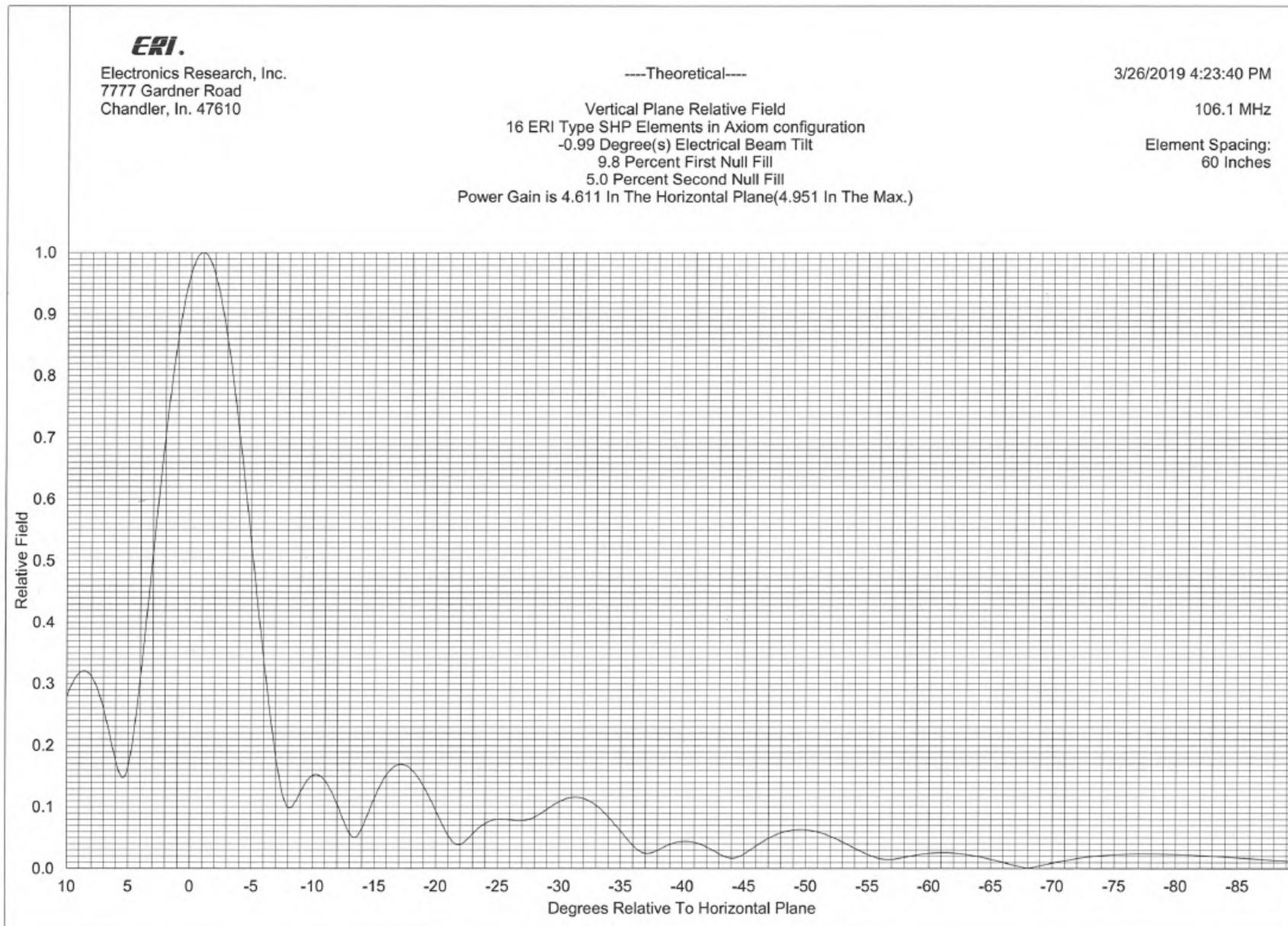
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16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System

(Antenna system modified to include electrical beam tilt and first and second null fill)

## Preliminary Power Analysis at Maximum HD Radio

<b>Antenna Model:</b>	SHPXA-16BC-HW-SP-2		<i>Digital (Maximum Allowed)</i>	
	<i>Analog</i>		<i>Lower Sideband</i>	<i>Upper Sideband</i>
<b>Call Letters:</b>	KQMV (FM)			
<b>Frequency:</b>	92.5 MHz		-14 dBc	-14 dBc
<b>ERP:</b>	60.000 kW	17.782 dBk	2.400 kW	3.802 dBk
<b>Polarization:</b>	Circular		Circular	
<b>Antenna Gain:</b>	4.398 Numeric	6.433 dB	4.398 Numeric	6.433 dB
<b>Antenna Input Power:</b>	13.643 kW	11.349 dBk	0.546 kW	-2.630 dBk
<b>Peak Voltage:</b>	1168 volts		467 volts	
<b>Transmission Line Type:</b>	6-1/8-inch, 50 ohm, rigid line (dual runs)		6-1/8-inch, 50 ohm, rigid line (dual runs)	
<b>Transmission Line Length:</b>	350 feet	106.7 meters	350 feet	106.7 meters
<b>Transmission Line Attenuation:</b>	0.047 dB/100-feet		0.047 dB/100-feet	
<b>Line Loss:</b>	-0.524 kW	0.164 dB	-0.021 kW	0.164 dB
<b>Line Efficiency:</b>	96.304%		96.304%	
<b>Power Output from Combiner:</b>	14.166 kW	11.513 dBk	0.567 kW	-2.467 dBk
<b>Peak Voltage:</b>	1190 volts		476 volts	
<b>Combiner Losses:</b>	-1.417 kW	0.414 dB	-0.057 kW	0.414 dB
<b>Transmitter Power Output:</b>	15.583 kW	11.927 dBk	0.623 kW	-2.053 dBk
<b>At Band Pass Filter Outputs by Type:</b>	7.083 kW	841 volts	0.283 kW	337 volts
<b>Total Analog and Digital:</b>	7.366 kW	1,178 volts		
<b>Combined Power at Wideband Input:</b>	14.166 kW	1,190 volts	0.567 kW	476 volts
<b>Total Analog and Digital:</b>	14.733 kW	1,666 volts		
<b>Call Letters:</b>	KSWD (FM)		<i>Lower Sideband</i>	<i>Upper Sideband</i>
<b>Frequency:</b>	94.1 MHz		-14 dBc	-10 dBc
<b>ERP:</b>	73.000 kW	18.633 dBk	5.110 kW	7.084 dBk
<b>Polarization:</b>	Circular		Circular	
<b>Antenna Gain:</b>	4.479 Numeric	6.512 dB	4.479 Numeric	6.512 dB
<b>Antenna Input Power:</b>	16.298 kW	12.121 dBk	1.141 kW	0.572 dBk
<b>Peak Voltage:</b>	1277 volts		676 volts	
<b>Transmission Line Type:</b>	6-1/8-inch, 50 ohm, rigid line (dual runs)		6-1/8-inch, 50 ohm, rigid line (dual runs)	
<b>Transmission Line Length:</b>	350 feet	106.7 meters	350 feet	106.7 meters
<b>Transmission Line Attenuation:</b>	0.047 dB/100-feet		0.047 dB/100-feet	
<b>Line Loss:</b>	-0.631 kW	0.165 dB	-0.044 kW	0.165 dB

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16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System

(Antenna system modified to include electrical beam tilt and first and second null fill)

## Preliminary Power Analysis at Maximum HD Radio

<b>Antenna Model:</b> SHPXA-16BC-HW-SP-2			
	<i>Analog</i>	<i>Digital (Maximum Allowed)</i>	
<b>Line Efficiency:</b>	96.272%		96.272%
<b>Power Output from Combiner:</b>	16.929 kW	12.286 dBk	1.185 kW
<b>Peak Voltage:</b>	1301 volts		688 volts
<b>Combiner Losses:</b>	-1.144 kW	0.284 dB	-0.080 kW
<b>Power Output from All Pass Diplexer:</b>	18.073 kW	12.570 dBk	1.265 kW
<b>Peak Voltage:</b>	1,344.38 volts		711.38 volts
<b>All Pass Diplexer Losses:</b>	-1.293 kW	0.300 dB	-0.395 kW
<b>Transmitter Power Output:</b>	19.366 kW	12.870 dBk	1.660 kW
<b>At Band Pass Filter Outputs by Type:</b>	16.120 kW	1,792 volts	0.916 kW
<b>Total Analog and Digital:</b>	17.036 kW	2,631 volts	
<b>Combined Power at Wideband Input:</b>	32.240 kW	2,535 volts	1.832 kW
<b>Total Analog and Digital:</b>	34.071 kW	3,722 volts	1,187 volts
<b>Call Letters:</b> KJAQ (FM)		<i>Lower Sideband</i>	<i>Upper Sideband</i>
<b>Frequency:</b>	96.5 MHz	-10 dBc	-10 dBc
<b>ERP:</b>	70.000 kW	18.451 dBk	7.000 kW
<b>Polarization:</b>	Circular		8.451 dBk
<b>Antenna Gain:</b>	4.595 Numeric	6.623 dB	Circular
<b>Antenna Input Power:</b>	15.234 kW	11.828 dBk	4.595 Numeric
<b>Peak Voltage:</b>	1234 volts		6.623 dB
<b>Transmission Line Type:</b>	6-1/8-inch, 50 ohm, rigid line (dual runs)		1.523 kW
<b>Transmission Line Length:</b>	350 feet	106.7 meters	781 volts
<b>Transmission Line Attenuation:</b>	0.048 dB/100-feet		6-1/8-inch, 50 ohm, rigid line (dual runs)
<b>Line Loss:</b>	-0.598 kW	0.167 dB	350 feet
<b>Line Efficiency:</b>	96.225%		106.7 meters
<b>Power Output from Combiner:</b>	15.832 kW	11.995 dBk	0.048 dB/100-feet
<b>Peak Voltage:</b>	1258 volts		<b>Line Loss:</b>
<b>Combiner Losses:</b>	-0.834 kW	0.223 dB	-0.060 kW
<b>Transmitter Power Output:</b>	16.666 kW	12.218 dBk	0.167 dB
			96.225%
<b>At Band Pass Filter Outputs by Type:</b>	24.036 kW	2,682 volts	1.583 kW
<b>Total Analog and Digital:</b>	25.743 kW	4,084 volts	796 volts
			1.995 dBk
			0.223 dB
			1.667 kW
			2.218 dBk
<b>At Band Pass Filter Outputs by Type:</b>	24.036 kW	2,682 volts	1.707 kW
<b>Total Analog and Digital:</b>	25.743 kW	4,084 volts	1,402 volts

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16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System

(Antenna system modified to include electrical beam tilt and first and second null fill)

## Preliminary Power Analysis at Maximum HD Radio

<b>Antenna Model:</b> SHPXA-16BC-HW-SP-2			
		<i>Analog</i>	<i>Digital (Maximum Allowed)</i>
<b>Combined Power at Wideband Input:</b>	48.071 kW	3,793 volts	3.415 kW
<b>Total Analog and Digital:</b>	51.486 kW	5,776 volts	1,983 volts
<b>Call Letters:</b> KNUC-FM		<i>Lower Sideband</i>	<i>Upper Sideband</i>
<b>Frequency:</b>	98.9 MHz	-14 dBc	-10 dBc
<b>ERP:</b>	68.000 kW	18.325 dBk	4.760 kW
<b>Polarization:</b>	Circular	Circular	6.776 dBk
<b>Antenna Gain:</b>	4.701 Numeric	6.722 dB	4.701 Numeric
<b>Antenna Input Power:</b>	14.465 kW	11.603 dBk	6.722 dB
<b>Peak Voltage:</b>	1203 volts	1.013 kW	0.054 dBk
<b>Transmission Line Type:</b>	6-1/8-inch, 50 ohm, rigid line (dual runs)	636 volts	6-1/8-inch, 50 ohm, rigid line (dual runs)
<b>Transmission Line Length:</b>	350 feet	106.7 meters	350 feet
<b>Transmission Line Attenuation:</b>	0.048 dB/100-feet	0.048 dB/100-feet	106.7 meters
<b>Line Loss:</b>	-0.575 kW	0.169 dB	-0.040 kW
<b>Line Efficiency:</b>	96.179%	0.169 dB	96.179%
<b>Power Output from Combiner:</b>	15.040 kW	11.772 dBk	1.053 kW
<b>Peak Voltage:</b>	1226 volts	0.223 dBk	649 volts
<b>Combiner Losses:</b>	-0.840 kW	0.236 dB	-0.059 kW
<b>Transmitter Power Output:</b>	15.880 kW	12.008 dBk	0.236 dB
		1.112 kW	0.459 dBk
<b>At Band Pass Filter Outputs by Type:</b>	31.555 kW	3,549 volts	2.234 kW
<b>Total Analog and Digital:</b>	33.789 kW	5,410 volts	1,861 volts
<b>Combined Power at Wideband Input:</b>	63.111 kW	5,019 volts	4.468 kW
<b>Total Analog and Digital:</b>	67.579 kW	7,651 volts	2,632 volts
<b>Call Letters:</b> KZOK-FM		<i>Lower Sideband</i>	<i>Upper Sideband</i>
<b>Frequency:</b>	102.5 MHz	-10 dBc	-10 dBc
<b>ERP:</b>	73.000 kW	18.633 dBk	7.300 kW
<b>Polarization:</b>	Circular	Circular	8.633 dBk
<b>Antenna Gain:</b>	4.840 Numeric	6.848 dB	4.840 Numeric
<b>Antenna Input Power:</b>	15.083 kW	11.785 dBk	6.848 dB
<b>Peak Voltage:</b>	1228 volts	1.508 kW	1.785 dBk
<b>Transmission Line Type:</b>	6-1/8-inch, 50 ohm, rigid line (dual runs)	777 volts	6-1/8-inch, 50 ohm, rigid line (dual runs)

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16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System

(Antenna system modified to include electrical beam tilt and first and second null fill)

## Preliminary Power Analysis at Maximum HD Radio

<b>Antenna Model:</b> SHPXA-16BC-HW-SP-2				
	<i>Analog</i>	<i>Digital (Maximum Allowed)</i>		
<b>Transmission Line Length:</b>	350 feet	106.7 meters	350 feet	106.7 meters
<b>Transmission Line Attenuation:</b>	0.049 dB/100-feet		0.049 dB/100-feet	
<b>Line Loss:</b>	-0.610 kW	0.172 dB	-0.061 kW	0.172 dB
<b>Line Efficiency:</b>	96.110%		96.110%	
<b>Power Output from Combiner:</b>	15.693 kW	11.957 dBk	1.569 kW	1.957 dBk
<b>Peak Voltage:</b>	1253 volts		792 volts	
<b>Combiner Losses:</b>	-1.111 kW	0.297 dB	-0.111 kW	0.297 dB
<b>Power Output from All Pass Diplexer:</b>	16.804 kW	12.254 dBk	1.680 kW	2.254 dBk
<b>Peak Voltage:</b>	1,296.30 volts		819.85 volts	
<b>All Pass Diplexer Losses:</b>	-1.285 kW	0.320 dB	-0.639 kW	1.400 dB
<b>Transmitter Power Output:</b>	18.089 kW	12.574 dBk	2.320 kW	3.654 dBk
<b>At Band Pass Filter Outputs by Type:</b>	39.957 kW	4,465 volts	3.074 kW	2,441 volts
<b>Total Analog and Digital:</b>	43.031 kW	6,906 volts		
<b>Combined Power at Wideband Input:</b>	79.915 kW	6,315 volts	6.148 kW	3,452 volts
<b>Total Analog and Digital:</b>	86.063 kW	9,768 volts		
<b>Call Letters:</b>	KBKS-FM		<i>Lower Sideband</i>	<i>Upper Sideband</i>
<b>Frequency:</b>	106.1 MHz		-14 dBc	-14 dBc
<b>ERP:</b>	73.000 kW	18.633 dBk	2.920 kW	4.654 dBk
<b>Polarization:</b>	Circular		Circular	
<b>Antenna Gain:</b>	4.951 Numeric	6.947 dB	4.951 Numeric	6.947 dB
<b>Antenna Input Power:</b>	14.744 kW	11.686 dBk	0.590 kW	-2.293 dBk
<b>Peak Voltage:</b>	1214 volts		486 volts	
<b>Transmission Line Type:</b>	6-1/8-inch, 50 ohm, rigid line (dual runs)		6-1/8-inch, 50 ohm, rigid line (dual runs)	
<b>Transmission Line Length:</b>	350 feet	106.7 meters	350 feet	106.7 meters
<b>Transmission Line Attenuation:</b>	0.050 dB/100-feet		0.050 dB/100-feet	
<b>Line Loss:</b>	-0.608 kW	0.175 dB	-0.024 kW	0.175 dB
<b>Line Efficiency:</b>	96.042%		96.042%	
<b>Power Output from Combiner:</b>	15.352 kW	11.862 dBk	0.614 kW	-2.118 dBk
<b>Peak Voltage:</b>	1239 volts		496 volts	
<b>Combiner Losses:</b>	-0.925 kW	0.254 dB	-0.037 kW	0.254 dB
<b>Transmitter Power Output:</b>	16.277 kW	12.116 dBk	0.651 kW	-1.864 dBk

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16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System

(Antenna system modified to include electrical beam tilt and first and second null fill)

## Preliminary Power Analysis at Maximum HD Radio

Antenna Model: SHPXA-16BC-HW-SP-2

Analog

Digital (Maximum Allowed)

<b>At Band Pass Filter Outputs by Type:</b>	47.633 kW	5,341 volts	3.381 kW	2,791 volts
<b>Total Analog and Digital:</b>	51.015 kW	8,132 volts		
<b>Combined Power at Combined Output:</b>	95.267 kW	7,555 volts	6.762 kW	3,948 volts
<b>Total Analog and Digital:</b>	102.029 kW	11,502 volts		
<b>Power into Upper Line by Type:</b>	29.206 kW	4,185 volts	2.063 kW	2,184 volts
<b>Total Analog and Digital:</b>	31.269 kW	6,368 volts		
<b>Power into Lower Line by Type:</b>	63.806 kW	6,185 volts	4.508 kW	3,228 volts
<b>Total Analog and Digital:</b>	68.314 kW	9,413 volts		
<b>At Upper Antenna Input by Type:</b>	28.093 kW	4,104 volts	1.985 kW	2,142 volts
<b>Total Analog and Digital:</b>	30.077 kW	6,246 volts		
<b>At Lower Antenna Input by Type:</b>	61.374 kW	6,066 volts	4.336 kW	3,166 volts
<b>Total Analog and Digital:</b>	65.710 kW	9,232 volts		

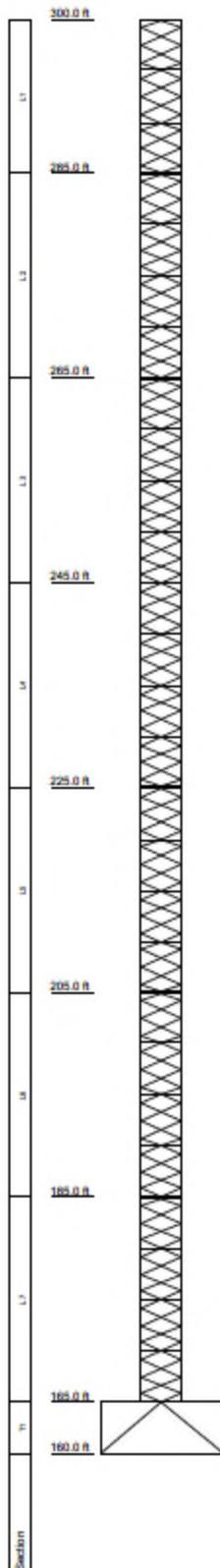
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16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System  
(Antenna system modified to include electrical beam tilt and first and second null fill)

## Lambda™ Optimized FM Mounting System

American Tower Corporation

**16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System**  
 (Antenna system modified to include electrical beam tilt and first and second null fill)



**DESIGNED APPURTENANCE LOADING**

TYPE	ELEVATION	TYPE	ELEVATION
Beacon/Spur (Conduit)	300	MP-4-AC-HW-Radomes 102.5 MHz (3' Flex)	285 - 250.7
RYMSAAT15-250 UHF Panel (1 5/8" Flex)	299 - 295	SHPX-16BC-HW-Radomes-SP (1/2) 6 (1/8" Rigid)	242.5 - 167.5
MP-3-AC-FW-DA-Radomes 99.9 MHz (3' Flex)	293.5 - 273.9	Index Plate	165

**MATERIAL STRENGTH**

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

**TOWER DESIGN NOTES**

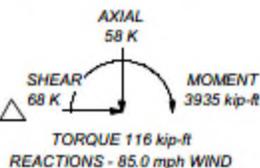
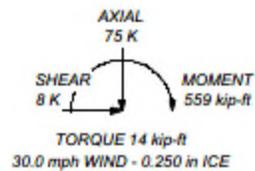
1. Tower is located in King County, Washington.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 85.0 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 30.0 mph basic wind with 0.25 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60.0 mph wind.
6. Tower Structure Class II.
7. Topographic Category 5 with Crest Height of 2175.000 ft
8. L = 4558'
9. x = 117'
10. Tower sections have flange connections.
11. Typical connections use galvanized A325 bolts or equal substitute along with nuts and/or nut locking devices. Installation per ANSI/TIA-222 specifications.
12. Tower members are "hot dip" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
13. All welds utilize ER70S-6 and/or E70C-6M electrodes.
14. PRELIMINARY DESIGN - The final design may incorporate changes from the details provided.
15. This lambda structure provides a base index plate to mount to existing structure.
16. Tower is designed to a nominal windspeed of 85 mph (3-sec. gust) equivalent to an ultimate windspeed of 110 mph (3-sec. gust) per section 1609.3 of the 2015 International Building Code for a Risk Category II structure.
17. Gh 1.1
18. ERI is not the EOR for the existing tower. This design does not consider the ability of the base structure to support this structure and equipment.

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:

DOWN: 398 K  
SHEAR: 40 K

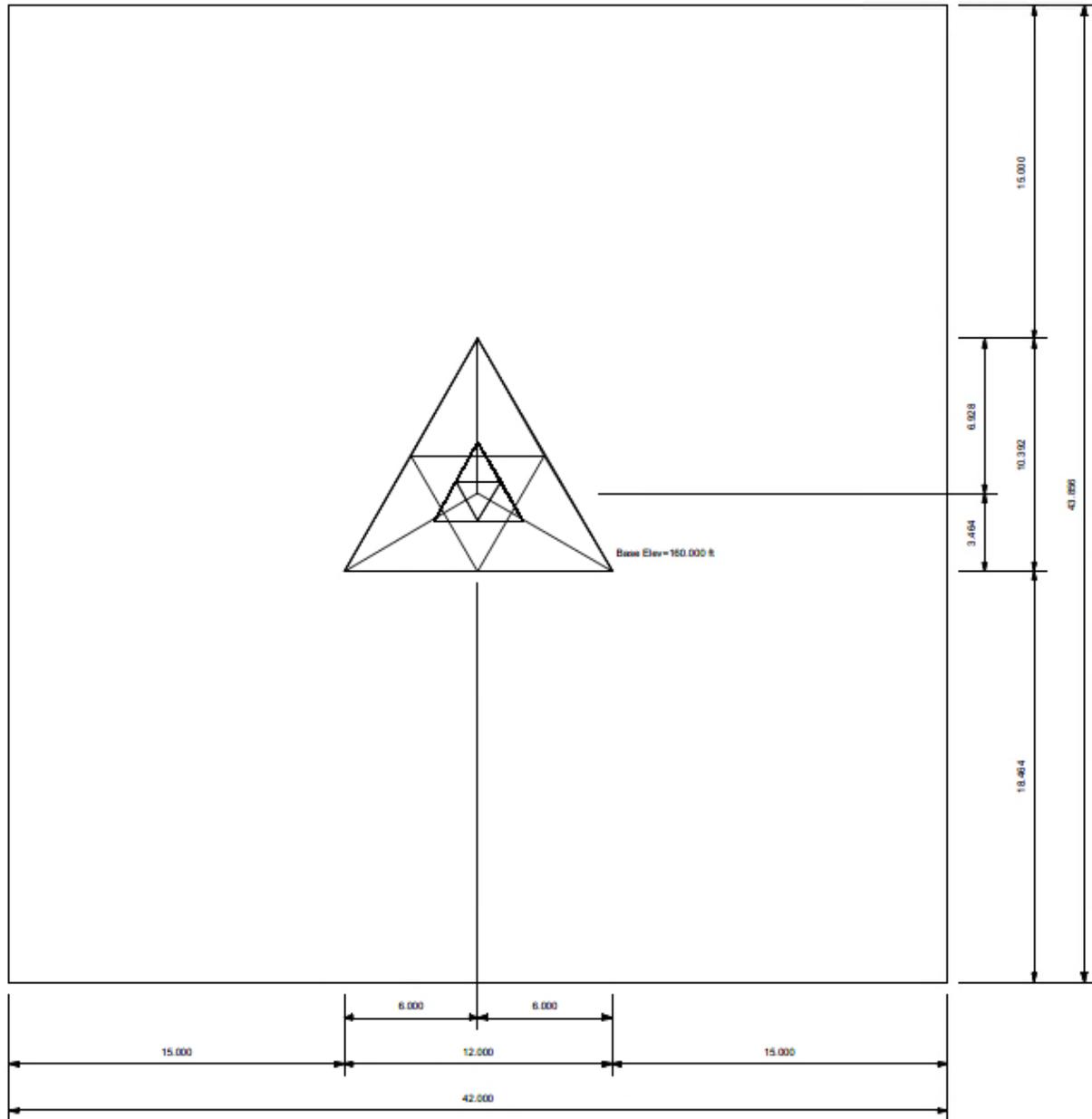
UPLIFT: -358 K  
SHEAR: 35 K



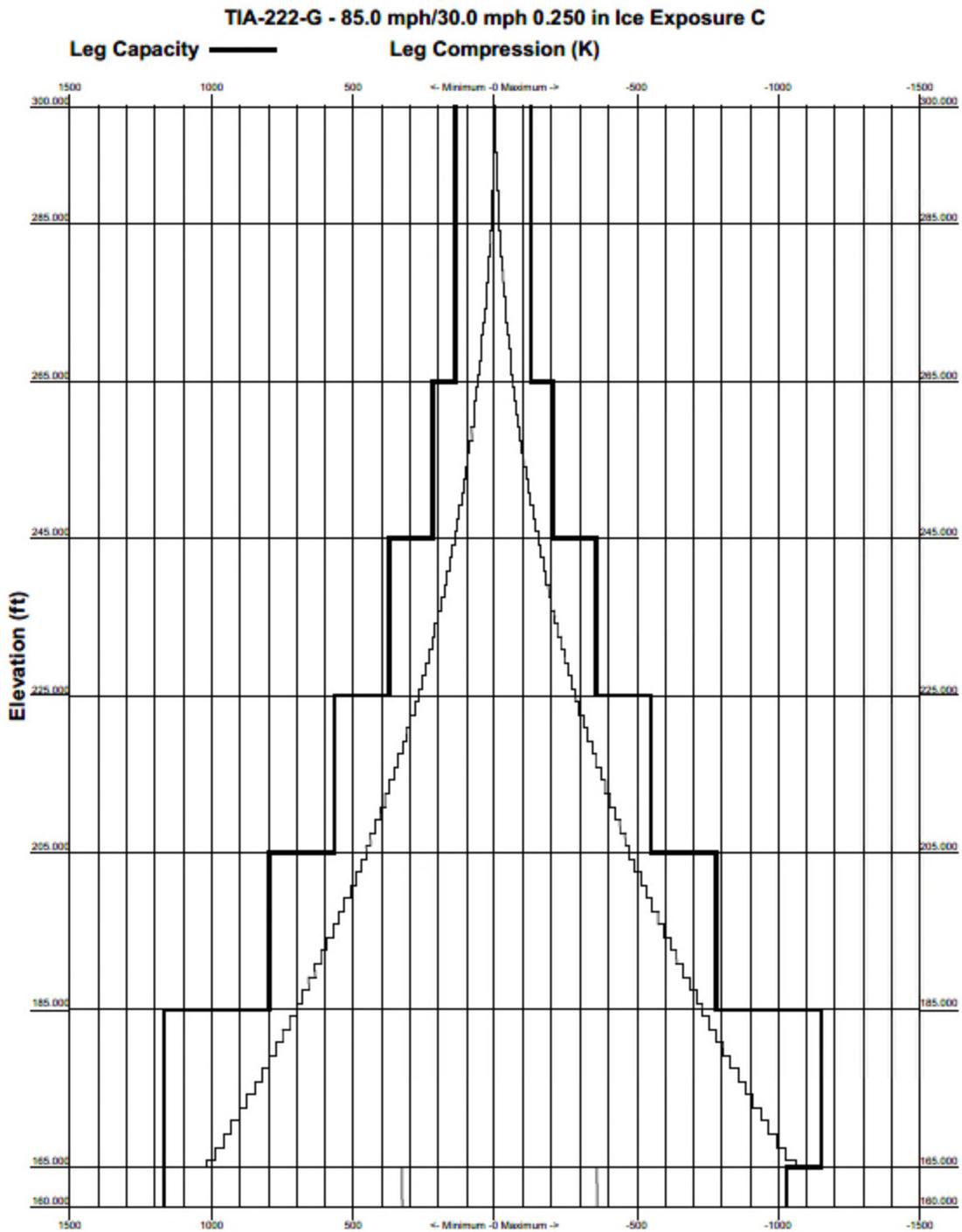
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(Antenna system modified to include electrical beam tilt and first and second null fill)

**Plot Plan**  
Total Area - 0.04 Acres

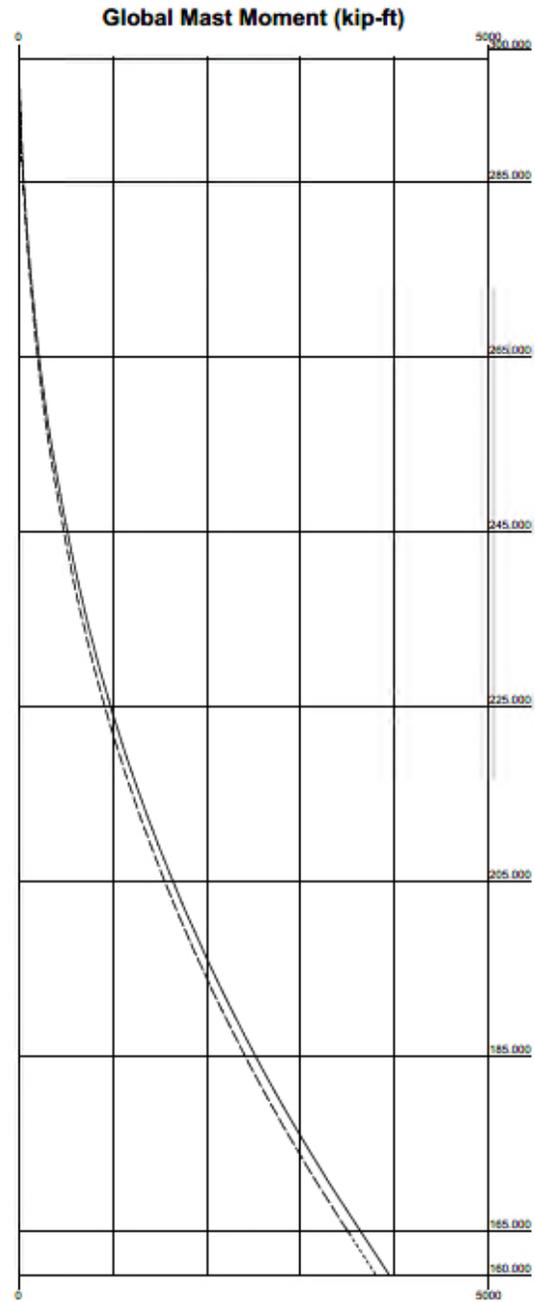
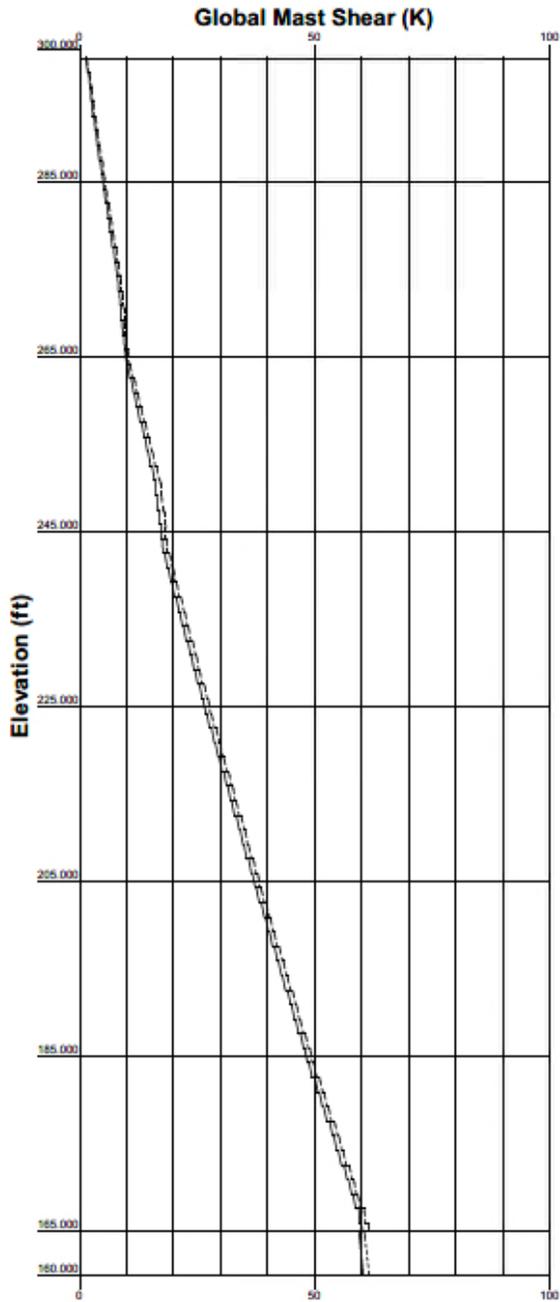


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TIA-222-G - 85.0 mph/30.0 mph 0.250 in Ice Exposure C  
Maximum Values  
—— Vx    - - - - Vz    —— Mx    - - - - Mz

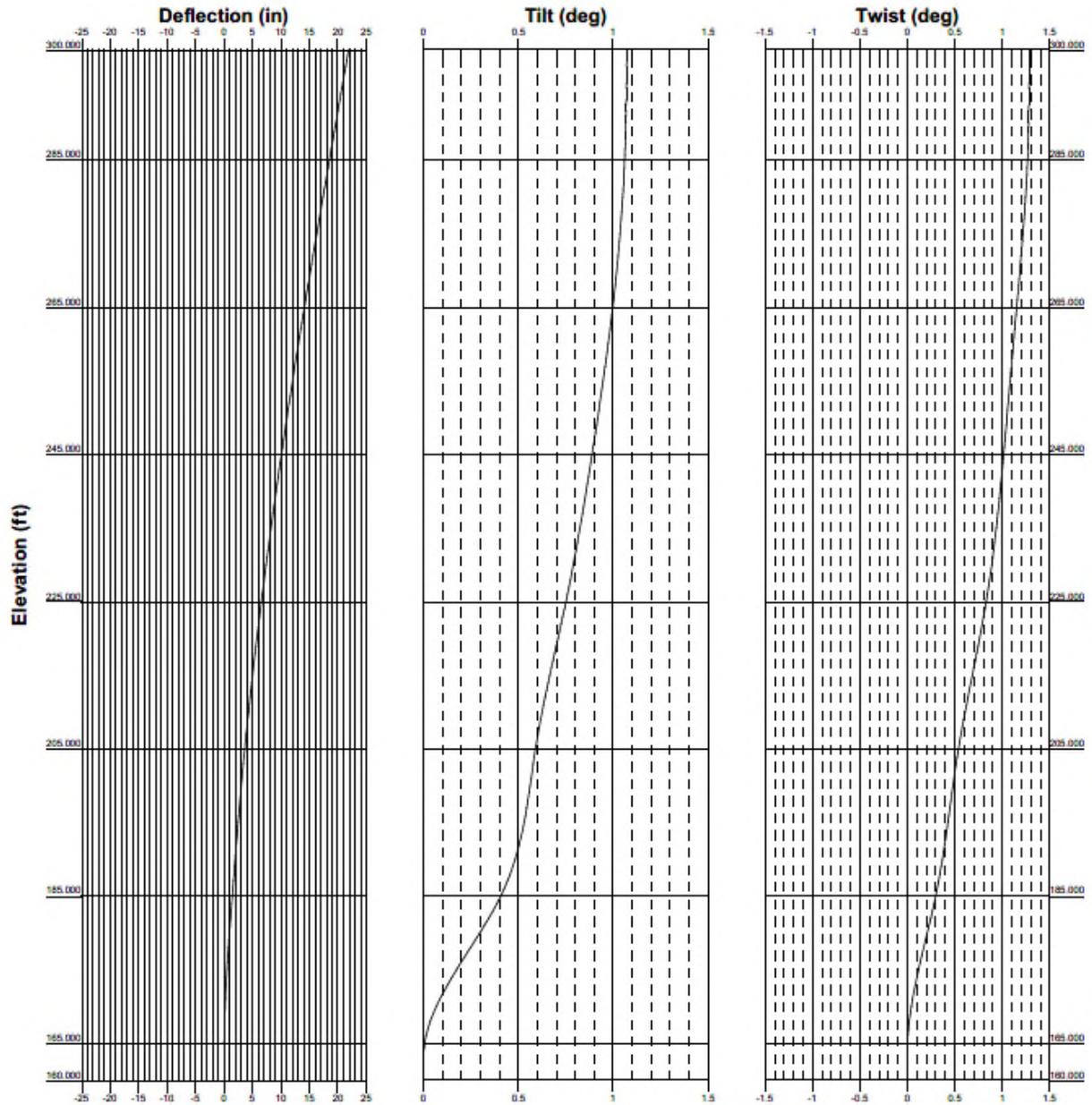


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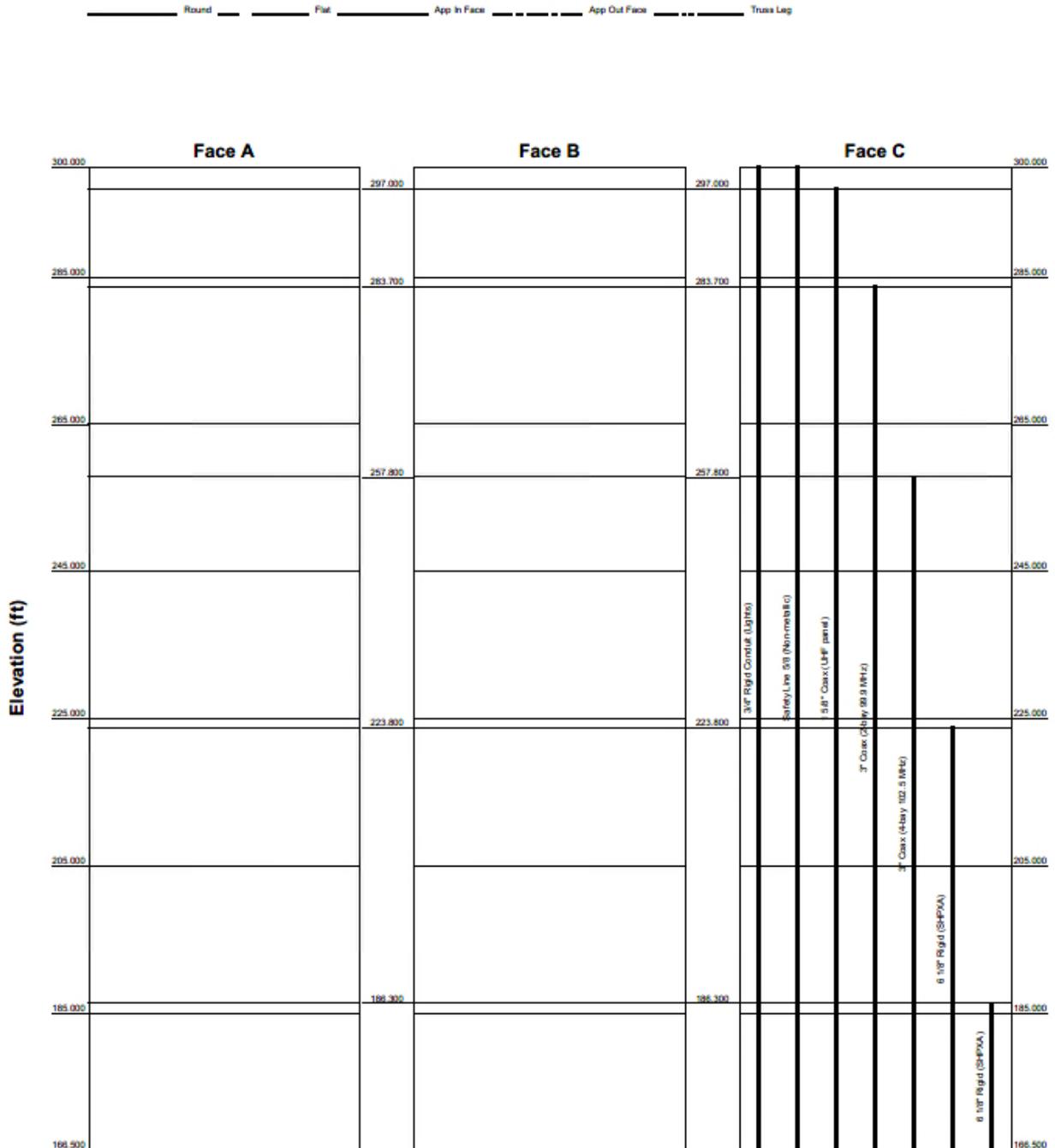
TIA-222-G - Service - 60.0 mph

Maximum Values



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 16-Bay AXIOM® Master FM Antenna with Lambda™ Optimized FM Mounting System  
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Feed Line Distribution Chart  
 166'6" - 300'



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**Wind Pressures and Ice Thickness**  
TIA-222-G - 85.0 mph/30.0 mph 0.250 in Ice Exposure C

