

# ***KLEIN BROADCAST ENGINEERING, L.L.C.***

*dedicated to improving the science and technology of radio & television communications*

**FEBRUARY 2010**

**ENGINEERING STATEMENT & EXHIBITS  
IN SUPPORT OF AN  
FCC FORM 340 APPLICATION  
FOR  
FM BROADCAST STATION CONSTRUCTION PERMIT  
(AUXILIARY ANTENNA)  
MARICOPA COUNTY COMMUNITY COLLEGE DISTRICT  
KBAQ(FM)  
FCC FACILITY ID# 40096  
FM CHANNEL 208 C1 / 89.5mHz  
PHOENIX, ARIZONA**

**INTRODUCTION and ENGINEERING STATEMENT**

**The Maricopa County Community College District, the licensee and permittee of NCEFM Broadcast Station KBAQ(FM), Phoenix, Arizona, has retained the firm of Klein Broadcast Engineering, L.L.C., to prepare this Engineering Statement and Exhibits in support of its instant application request to construct and operate when necessary an Auxiliary Antenna for Station KJZZ.**

**The Auxiliary Antenna proposed herein complies with all requirements of 47 C.F.R. Section 73.1675(a)(1)(ii).**

## **ENGINEERING STATEMENT cont'd page two: KBAQ Aux Antenna**

### **THE REQUESTED FACILITY**

The proposed Auxiliary Antenna facility is specified as follows:

Geographic Coordinate Site Location: NL: 33-19-58 / WL: 111-03-53 (NAD-1927)

Overall Tower Height above Ground Level:	74.1 meters
Height of Radiation Center Above Mean Sea Level:	823 meters
Height of Radiation Center Above Ground Level:	26 meters
Height of Radiation Center Above Average Terrain:	110 meters

Ground Level at Site Above Mean Sea Level:	797 meters
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Effective Radiated Power H&V:	10.0 kW
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Tower Structure Registration (ASR) Number:	1003590
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### **THE EXHIBITS**

**Exhibit E-1 is a copy of the KBAQ Main Transmission System Construction Permit.**

**The facility authorized in this construction permit has been constructed and is**

**awaiting the completion of construction of Station KLVK at Fountain Hills,**

**Arizona, so the applicant may file FCC Form 302-FM for Program Test Authority**

**and Station License to cover the outstanding KBAQ Construction Permit.**

**The requested Auxiliary Antenna proposed herein is located at the same site as**

**authorized in the KBAQ FCC FM Broadcast Station Construction Permit, File**

**Number BPED-20060227AHT. It is included herein to aid Commission staff in the**

**processing of the instant application.**

**Exhibit E-2 is a contour map with two separate 60dBu contours plotted thereon.**

**The first contour is the 60dBu f(50,50) contour (green) is produced by the main**

**transmission facility as authorized in the above captioned FCC FM Broadcast**

**Station Construction Permit.**

**ENGINEERING STATEMENT & EXHIBITS cont'd page three: KBAQ Aux**

**The second contour (blue) is produced from the proposed Auxiliary Antenna System proposed herein. As may be seen in this exhibit the 60dBu contour from the proposed Auxiliary Antenna System is wholly contained within the 60dBu contour produced by the Main KJZZ Main Transmission System Construction Permit located at the common site in compliance with 47 C.F.R. Section 73.1675(a)(1)(ii).**

**The terrain data used to generate the contours in Exhibit E-2 found in this application came from the DMA 3 Arc Second Digitized Terrain Datafile, Conus. The method use to generate the actual contours on Exhibit E-2 is the FCC Standard Prediction Method f(50,50), 360 Radials.**

**Exhibit E-10 is a complete and comprehensive RFR study and analysis of the proposed KBAQ Auxiliary Antenna facility. It shows compliance with the Commission's Guidelines of Human Exposure to Non-ionizing RF radiation.**

**ENGINEERING STATEMENT & EXHIBITS cont'd page four: KBAQ Aux**

**This Engineering Statement and attached Exhibits clearly support the grant of the requested Auxiliary Antenna Construction Permit Facility as specified for Station KBAQ(FM). The Auxiliary Antenna Facility will be used for emergency purposes only or at times the main transmission facility for Station KBAQ(FM) must be taken off air for maintenance or repair.**

**Respectfully submitted,**

**Elliott Kurt Klein,  
Consulting Broadcast Engineer  
Maricopa County Community College District  
FM Broadcast Station KBAQ(FM)  
Phoenix, Arizona**

**27 February 2010**

**EXHIBIT E-1**

**United States of America**  
**FEDERAL COMMUNICATIONS COMMISSION**  
**FM BROADCAST STATION CONSTRUCTION PERMIT**

Authorizing Official:

Official Mailing Address:

MARICOPA COUNTY COMMUNITY COLLEGE DISTRICT  
2323 W. 14TH STREET  
TEMPE AZ 85281

Rodolfo F. Bonacci  
Assistant Chief  
Audio Division  
Media Bureau

Facility ID: 40096

Call Sign: KBAQ

Permit File Number: BPED-20060227AHT

Grant Date: January 07, 2009

This permit expires 3:00 a.m.  
local time, 36 months after the  
grant date specified above.

Subject to the provisions of the Communications Act of 1934, as amended, subsequent acts and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions set forth in this permit, the permittee is hereby authorized to construct the radio transmitting apparatus herein described. Installation and adjustment of equipment not specifically set forth herein shall be in accordance with representations contained in the permittee's application for construction permit except for such modifications as are presently permitted, without application, by the Commission's Rules.

Commission rules which became effective on February 16, 1999, have a bearing on this construction permit. See Report & Order, Streamlining of Mass Media Applications, MM Docket No. 98-43, 13 FCC RCD 23056, Para. 77-90 (November 25, 1998); 63 Fed. Reg. 70039 (December 18, 1998). Pursuant to these rules, this construction permit will be subject to automatic forfeiture unless construction is complete and an application for license to cover is filed prior to expiration. See Section 73.3598.

Equipment and program tests shall be conducted only pursuant to Sections 73.1610 and 73.1620 of the Commission's Rules.

Name of Permittee: MARICOPA COUNTY COMMUNITY COLLEGE DISTRICT

Station Location: AZ-PHOENIX

Frequency (MHz): 89.5

Channel: 208

Class: C1

Hours of Operation: Unlimited

Transmitter: Type Accepted. See Sections 73.1660, 73.1665 and 73.1670 of the Commission's Rules.

Transmitter output power: As required to achieve authorized ERP.

Antenna type: Directional

Antenna Coordinates: North Latitude: 33 deg 19 min 58 sec

West Longitude: 112 deg 03 min 53 sec

	Horizontally Polarized Antenna	Vertically Polarized Antenna
Effective radiated power in the Horizontal Plane (kW):	30.0	30.0
Maximum effective radiated power (kW):	30.0	30.0
Height of radiation center above ground (Meters):	44	44
Height of radiation center above mean sea level (Meters):	841	841
Height of radiation center above average terrain (Meters):	474	474

Antenna structure registration number: 1003590

Overall height of antenna structure above ground (including obstruction lighting if any) see the registration for this antenna structure.

Special operating conditions or restrictions:

- 1 BEFORE PROGRAM TESTS ARE AUTHORIZED, permittee shall submit the results of a complete proof-of-performance to establish the horizontal plane radiation patterns for both the horizontally and vertically polarized radiation components. This proof-of-performance may be accomplished using the complete full size antenna, or individual bays therefrom, mounted on a supporting structure of identical dimensions and configuration as the proposed structure, including all braces, ladders, conduits, coaxial lines, and other appurtenances; or using a carefully manufactured scale model of the entire antenna, or individual bays therefrom, mounted on an equally scaled model of the proposed supporting structure, including all appurtenances. Engineering exhibits should include a description of the antenna testing facilities and equipment employed, including appropriate photographs or sketches and a description of the testing procedures, including scale factor, measurements frequency, and equipment calibration.
- 2 BEFORE PROGRAM TESTS ARE AUTHORIZED, permittee/licensee shall submit an affidavit that the installation of the directional antenna system was overseen by a qualified engineer. This affidavit shall include a certification by the engineer that the antenna was installed pursuant to the manufacturer's instructions and list the qualifications of the certifying engineer.

## Special operating conditions or restrictions:

- 3 BEFORE PROGRAM TESTS ARE AUTHORIZED, permittee shall submit an affidavit from a licensed surveyor to establish that the directional antenna has been oriented at the proper azimuth.

- 4 The relative field strength of neither the measured horizontally nor vertically polarized radiation component shall exceed at any azimuth the value indicated on the composite radiation pattern authorized by this construction permit.

A relative field strength of 1.0 on the composite radiation pattern herein authorized corresponds to the following effective radiated power:

. 30.0 kilowatts (H&V) .

## Principal minima and their associated field strength limits:

110	-	170	degrees True:	13.147 kilowatts
190	-	200	degrees True:	14.995 kilowatts
220	-	240	degrees True:	15.038 kilowatts

- 5 Permittee has specified use of the antenna listed below to demonstrate compliance with the FCC radiofrequency electromagnetic field exposure guidelines. If any other type or size of antenna is to be used with the facilities authorized herein, a FORMAL REQUEST FOR PROGRAM TEST AUTHORITY must be filed in conjunction with FCC Form 302-FM, application for license, BEFORE program tests will be authorized. The request must include a revised RF field showing to demonstrate continued compliance with the FCC guidelines.

ERI rototiller (EPA Type 3), ten sections, one-half-wavelength spaced

- 6 The permittee shall submit a copy of the vertical plane radiation pattern for the beam tilt antenna with the FCC Form 302-FM Application for License.
- 7 This application is being granted prior to the completion of the international notification process. Therefore, any construction of and operation with the facilities specified herein is at applicant's own risk and subject to modification, suspension or termination without right to hearing, if objected to by the Comisión Federal de Telecomunicaciones (COFETEL) in Mexico or if found by the Commission or the COFETEL to be necessary in order to conform to the 1992 USA-Mexico FM Broadcasting Agreement. This condition will be removed if formal acceptance of the facilities granted herein is received from COFETEL.
- 8 Since the application proposes to mount its FM antenna above the co-located existing directional antenna of K207CO(FX), Sun Lakes, Arizona, (Facility Id# 88473) the permittee shall submit an exhibit including a statement from the manufacturer of K207CO(FX)'s directional antenna stating that the proposed antenna will have no adverse effect on the K207CO(FX) directional antenna pattern.

Special operating conditions or restrictions:

- 9 Program tests for KBAQ(FM), Phoenix, Arizona (Facility ID No. 40096) and KLVK(FM), Fountain Hills, Arizona (Facility ID No. 76329) with the facilities authorized in construction permits BPED-20060227AHT and BPED-20060227AIH respectively, must commence simultaneously. Furthermore, the licenses to cover these permits will be granted simultaneously.
- 10 Further modifications to the facilities of station KLVK(FM), Fountain Hills, Arizona will not be construed as a per se modification of KBAQ(FM)'s authorization. (See Educational Information Corporation, 6 FCC Rcd. 2207 (1991)).
- 11 The permittee/licensee in coordination with other users of the site must reduce power or cease operation as necessary to protect persons having access to the site, tower or antenna from radiofrequency electromagnetic fields in excess of FCC guidelines.

\*\*\* END OF AUTHORIZATION \*\*\*

## EXHIBIT E-2 KBAQ Main CP & Proposed Auxiliary 60dBu Contour Analysis

Klein Broadcast Engineering, L.L.C.

Job: KBAQ SM CP 20100227.fmj

Master Database: FCC CDBS 2010\_Feb\_27.fmd

Date: 2/27/2010

Lat: N33:19:58 Lon: W112:03:53 NAD-27(Map Center & KBAQ CP / Proposed Aux Site)

Scale: 1:1000000

Channel: 208 Class: C1

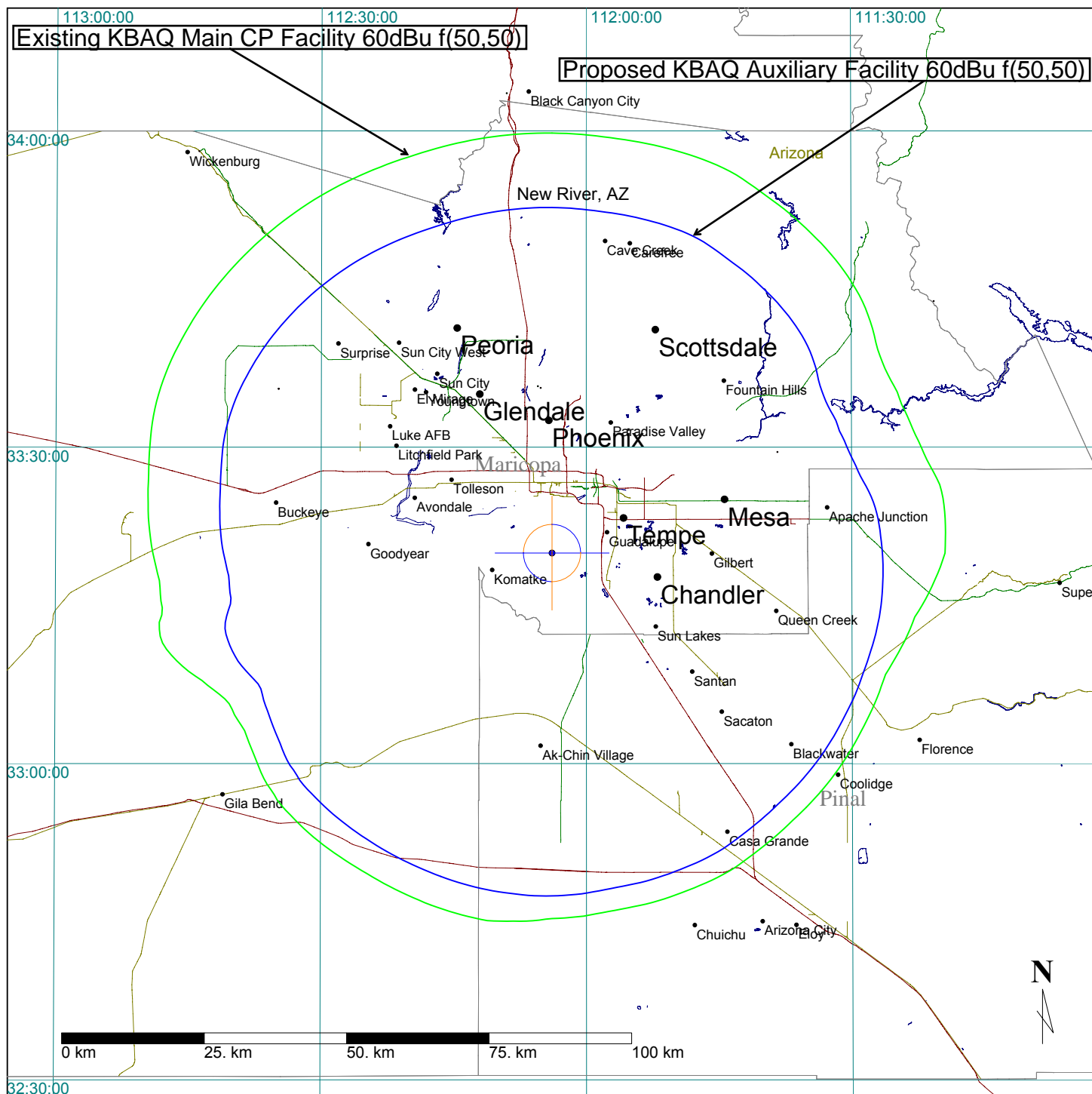
Status: Licensed, Construction Permit, Reserved

Terrain Database: DMA 3 Arc Second Digitized Terrain Datafile, Conus.

Contour Prediction method: FCC Standard f(50,50), 360 Radials.

Comments: Contour analysis of existing FCC CP for Main Facility & Proposed Auxiliary Facility

Description: EXHIBIT E-2 KBAQ Main CP & Proposed Aux 60dBu Contour Analysis



# ***KLEIN BROADCAST ENGINEERING, L.L.C.***

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FEBRUARY 2010

EXHIBIT E-10RHS  
FCC FORM 340 APPLICATION  
FOR FM BROADCAST STATION CONSTRUCTION PERMIT  
FOR  
AUXILIARY ANTENNA SYSTEM  
MARICOPA COUNTY COMMUNITY COLLEGE DISTRICT  
K B A Q  
FM CHANNEL 208 C1 / 89.5 mHz.  
PHOENIX, ARIZONA

## RF RADIATION HAZARD COMPLIANCE STATEMENT

The facilities proposed herein by the applicant, permittee or licensee, in this Engineering Exhibit comply with FCC O.S.T. Bulletin #65 and #65A as revised (1997) and the ANSI C-95.1-1982 RF and ANSI C95.1992 and the NCRP exposure guidelines. The interpolation of the figures from the above referenced document, page 18, supplement "A", shows a BEST case requirement of 15.7 meters height above ground level requirement for the radiation center of the proposed four (4) bay full wave length spaced FM broadcast antenna. A combined vertical and horizontal effective radiated power of 20.0 kilowatts was used for this study and determination (10.0 kW Horiz. & 10.0 kW Vert.) The radiation center of the FM broadcast antenna system is proposed at 26 meters above ground level (AGL), well within the requirement for the antenna as determined from the above referenced documents. The antenna specified and installed is an Electronics Research, Inc., model SHPX-4AC-SP, EPA Type 3, four (4) section, full wave length spaced, circularly polarized antenna. The antenna manufacturer, Electronics Research, Inc., states its antenna meets the BEST case requirements for downward radiation pattern according to the FCC O.S.T. Bulletin #65 Guidelines. The antenna proposed uses no beam tilt and no null fill.

Occupational compliance is certified by the reduction of operating power or the complete cessation of operation during such time maintenance personnel are on the antenna support structure. A transmitter "LOCK OUT" circuit will be installed to prevent accidental turn on of the transmission equipment during the time maintenance personnel are on the antenna support structure. The applicant, will cooperate with other site users in order to comply with The FCC Guidelines on Human Exposure to Non-Ionizing RF Radiation.

In addition to the preceding the applicant, has by computer program, performed additional calculations to predict RF power density at the base of the antenna support structure. This program predicts a maximum power density of 100.6079 microwatts/cm<sup>2</sup> at a distance of 9.75 meters from the base of the antenna support structure at a height of 2.0 meters above ground level. This is 50.3 % of the allowable RF power density for Uncontrolled areas under the FCC and ANSI/EPA Guidelines, being limited to: 200.0 microwatts/cm<sup>2</sup> for Uncontrolled areas and 1.00mW/cm<sup>2</sup> or (1,000 microwatts/cm<sup>2</sup>) for Controlled areas (areas within fencing). All other power density was calculated to be below this maximum predicted level for a distance of 0 to 1000 meters distance from the base of the antenna support structure at 2.0 meters above ground level.

There are other sources of significant RFR levels on the same proposed tower. The source is that of FM Broadcast Station KJZZ Main Facility, FCC File Number: BMLED-20090127ACM (FCC Facility ID# 40095) at Phoenix, Arizona. This station operates an Electronics Research, Inc.

(ERI) twelve (12) section, half-wave spaced FM Antenna array with a COR at 51 meters AGL. The maximum RFR level produced from this facility is 8.0667 uW/cm<sup>2</sup> at a distance of 581.75 meters from the base of the antenna support structure at 2 meters AGL.

A WORST case calculation could be made by summing the two maximum predicted RFR levels on the common site ( $100.6079 \text{ uW/cm}^2 + 8.0667 \text{ uW/cm}^2$ ) which when arithmetically summed equals a WORST case RFR level on the proposed site of  $113.4004 \text{ uW/cm}^2$  or 56.7% of the allowable maximum level of  $200.0 \text{ uW/cm}^2$  for uncontrolled areas.

Of course the KBAQ Main Transmission facility operates from this tower site also. However this facility was not included in this RFR analysis exhibit because the main facility would not be operating at the same time as the proposed auxiliary antenna system.

There are many other sources of significant RFR levels at the proposed South Mountain Electronics Communications Site at Phoenix, Arizona. The general public is protected from RFR levels in excess of FCC guidelines because the entire communications site perimeter is fenced with an eight foot high chain link fence. There are three locked gates at the site and only authorized personnel have access to these locked gates. Additionally, the firm of Hammett & Edison, has been retained to continuously monitor and study any changes that occur at the South Mountain Electronic Communications site. Hammett & Edison issues a complete and comprehensive RFR analysis and report to all broadcast users of the site each time a change is reported to them. They also make periodic RFR level measurements on the site to assure compliance with the Commission's Guidelines on Human Exposure to Non-Ionizing Radiofrequency Radiation. The facilities proposed herein for the KBAQ Auxiliary Antenna System were notified to Hammett & Edison on November 18, 2009 and are included in that firms most recent RFR analysis of the entire site. A copy of this analysis is available to the Commission upon request.

The computer program employed for the RFR analysis in this engineering exhibit uses either the Near Field or Far Field method for the calculation of power density and was written by the Commission's O.E.T. staff. In this particular case the Far Field Method was used. The formula used by the computer program was derived from the FCC O.S.T. Bulletin #65, as revised to date.

The formula may be stated in the following manner:

$$E(V/m) = 1.6 * 221.72 * \text{SQRT}(\text{ERP}) * (\text{element pattern factor}) * (\text{array factor}) / \text{DIST}$$

$$H(A/m) = 1.6 * 0.588 * \text{SQRT}(\text{ERP}) * (\text{element pattern factor}) * (\text{array factor}) / \text{DIST}$$

Where:

ERP = effective radiated power in kilowatts, relative to a half wave dipole.

DIST = distance in meters from the antenna radiation center to the observation point in meters.

The 1.6 factor found in the ANSI/EPA formula and used above at the beginning of each equation takes into account possible contributions from ground reflections. The element pattern factor in a linearly interpolated relative field value at the appropriate depression angle below the horizon as taken directly from the EPA data. The array factor is computed at the appropriate depression angle using the number of antenna elements, when normalized to 1.0 in the main lobe. This array factor only applies to antenna arrays of point sources where each source has equal power distribution and phase, and are uniformly spaced. The element patterns themselves can be associated with particular antenna designs. As of May 1986 there were six (6) element types identified for FM antennas as listed in the ANSI/EPA data and FCC Bulletin #65. The "crossed ring" EPA Type 3 element is used on the Electronics Research, Inc., model SHPX-4AC-SP, EPA Type 3 is listed in the EPA data and was used for the calculations contained herein.

The General Public will not have access to the antenna support structure base because the antenna support structure base will be protected by three locked gates and chain link fence, approximately 8 feet tall..

Only authorized personnel have access to the locked gate. This will prevent General Public access to the actual antenna support structure base and the entire South mountain Electronic Communications Site.

The applicant, has installed and posted RF Radiation Hazard Warning Signs in and around the site at approximately eye level for additional warning and safety.

A vertical pattern plot of the Electronics Research, Inc., model SHPX-4AC-SP (EPA Type 3) antenna to be employed as the KBAQ Auxiliary Antenna is included with this exhibit and is marked Figure 1. This plot clearly shows this antenna has greatly reduced downward radiation and meets the BEST case requirements of FCC Bulletin #65, as amended to date.

The plot Exhibit marked Figure 2. is a plot of the actual calculated power density in microwatts/cm<sup>2</sup> vs. distance. This plot shows the calculated maximum predicted power density of 100.6079 microwatts/cm<sup>2</sup> occurring at 9.75 meters distant from the base of the antenna support structure. It also shows, graphically, that all other calculated power density RFR levels are below this maximum between 0 meters and 1000 meters distant from the base of the antenna support structure.

The preceding assures compliance with the FCC, ANSI and NCRP requirements. Based on the preceding documents, tables, guidelines and calculations, the proposed operation of the proposed KBAQ Auxiliary Antenna transmission facility is in compliance with the FCC O.S.T. Bulletin #65 and the ANSI C- 95.1-1992 and the NCRP RF Exposure Guidelines as amended to date. The applicant, certifies compliance with the ANSI, NCRP and FCC Human Exposure Guidelines to Non-Ionizing RF Radiation.



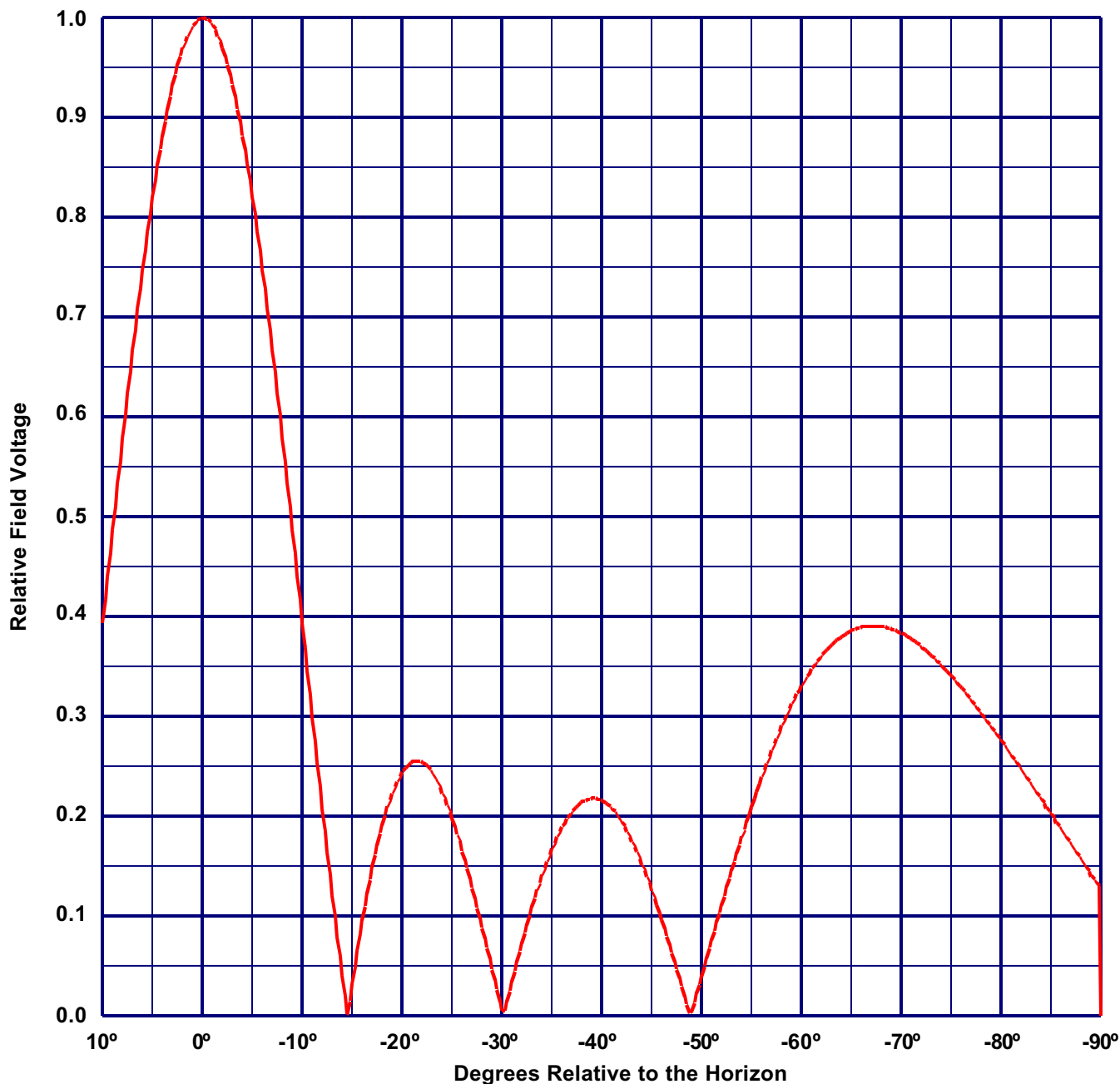
EXHIBIT E-10 FIGURE #1.

## Vertical Plane Relative Field Pattern

**ERI TYPE SHP, SHPX, MP, MPX, LP OR LPX ELEMENTS**

*A 4 level, 1 wave-length spaced non directional antenna for KBAQ Aux.*

*with 0° beam tilt, 0% null fill and a HIV maximum power ratio of 1.000*



**Vertical Polarization Gain:**

**Maximum: 2.133 (3.290 dB)**

**Horizontal Plane: 2.133 (3.290 dB)**

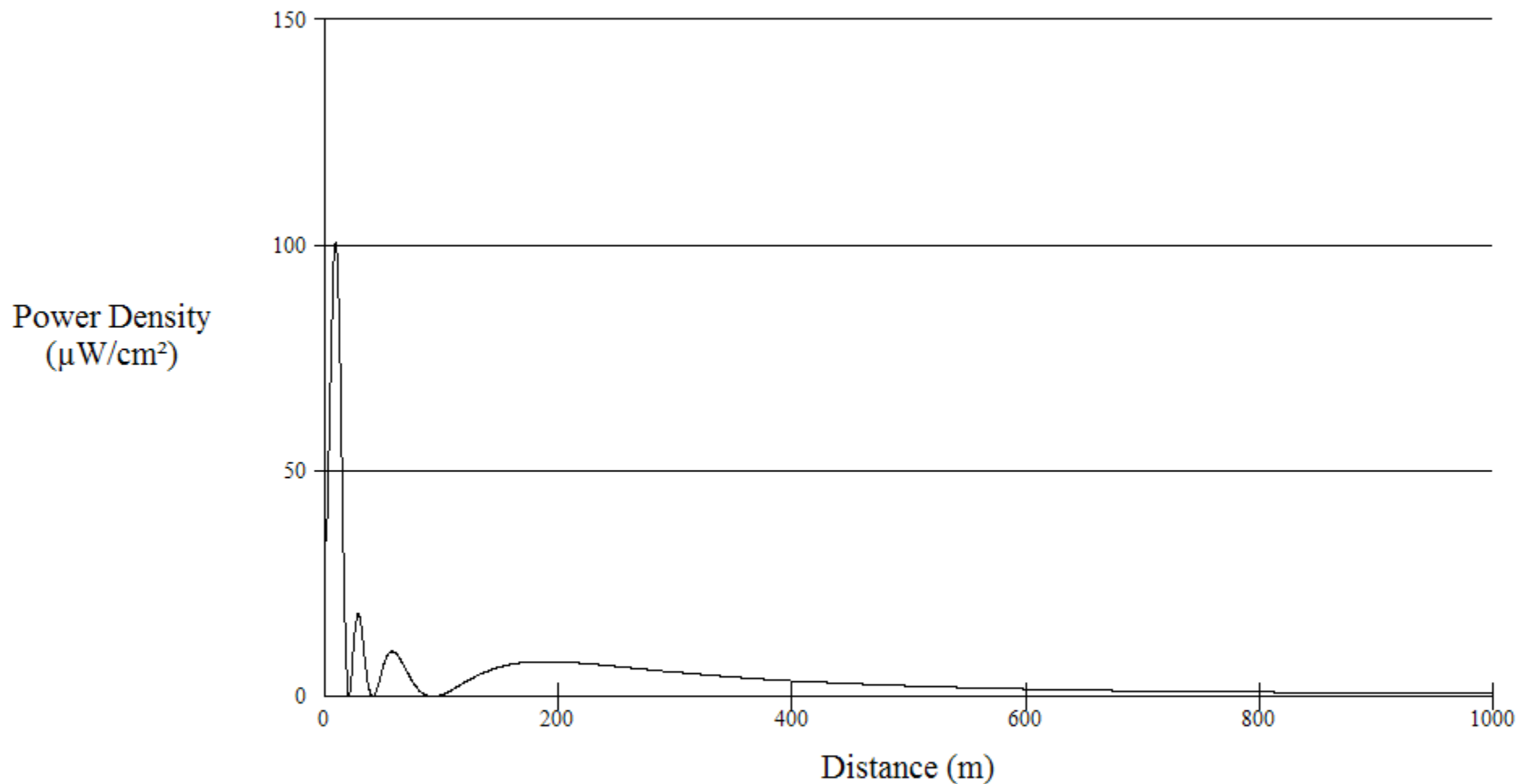
**Horizontal Polarization Gain:**

**Maximum: 2.133 (3.290 dB)**

**Horizontal Plane: 2.133 (3.290 dB)**

## Power Density vs Distance

EXHIBIT E-10 FIGURE #2.



Office of Engineering and Technology

Distance (m): 1000 Antenna Type: ERI or JAMPRO JBCP "Rototiller" (EPA) ▼

Horizontal ERP (W): 10000

Vertical ERP (W): 10000

Antenna Height (m): 30

Number of Elements: 4

Element Spacing: 1

Maximum RFR level = 100.6079 $\mu\text{W}/\text{cm}^2$  at a distance of 9.75 meters from the base of the antenna support structure, 2 meters above ground level.

Antenna Manufacturer & Model: Electronics Research, Inc. (ERI) SHPX-4AC-SP, a four section, full wavelength spaced, center fed FM broadcast antenna array.