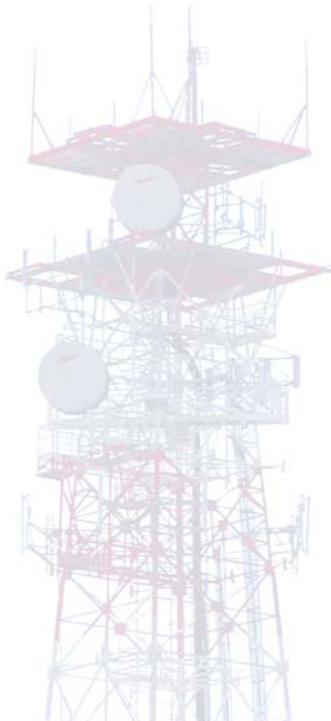




**RF**Engineers, Inc.

# Evaluation of Human Exposure to Radio Frequency Emissions



**Prepared for:**  
**Lane County School District 4J**  
**Radio Station KRVM-FM**  
**200 North Monroe Street**  
**Eugene, Oregon 97402**

**December 1<sup>st</sup> 2005**

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## Executive Summary:

This report summarizes an analysis performed by Joseph M. DiPietro, P.E. for the Lane County School District 4J, Eugene Oregon. The analysis modeled the radio frequency energy emitted from a proposed new configuration of radio station KRVM-FM. No other RF sources were modeled in this study. The purpose of this analysis is to determine if this facility will remain in compliance with the FCC's RF exposure requirements upon completion of a proposed upgrade.

The results of the analysis predict that the levels of RF radiation in areas within 315 meter of the site are increased by **less than 13% of the maximum guideline for general population/uncontrolled exposure**.

**CAUTION:** Even though this facility appears consistent with FCC guidelines, be aware that each site user must also meet requirements with respect to "on-tower" or other exposure by workers at the site (including RF exposure on one tower caused by sources on another tower or towers). These requirements include, but are not limited to the reduction or cessation of transmitter power when persons have access to the site, tower, or antenna. Such procedures must be coordinated among all tower users.

**See OET Bulletin 65 for further details.** OET Bulletin 65 is available from:  
<http://www.fcc.gov/oet/info/documents/bulletins/#65>

## Introduction:

### *RF Exposure Requirements*

In 1996, the FCC adopted guidelines and procedures for evaluating environmental effects of RF emissions. All applications subject to environmental processing filed on or after October 15, 1997 must demonstrate compliance with these requirements. These guidelines incorporate two tiers of exposure limits:

- **General population/uncontrolled** exposure limits apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public are always considered under this category when exposure is not employment-related.
- **Occupational/controlled** exposure limits apply to human exposure to RF fields when persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. These limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above the general populations/uncontrolled limits as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or some other appropriate means.

### *Method*

A description of the facility was obtained from FCC records, through interviews with involved parties and from other public sources.

Based on the available information, calculations were performed, in accordance with OET Bulletin 65. It was assumed that the facility radiated maximum ERP omni-directionally. A vertical pattern of the proposed antenna was obtained from the antenna manufacturer and applied to the model.

Calculations were performed for a point two meters above the ground from the base of the tower out 315-meters. Additionally, calculations were performed for a 5.5-meter high rooftop located between 57 and 77-meters from the base of the tower.

## Discussion:

### Site Details

The site consists of a 34-meter tower with a 4-bay  $1-\lambda$  spaced antenna mounted 30-meters AGL. The proposal is to replace the existing antenna with a new 6-bay  $1/2\lambda$  spaced antenna mounted 28-meters AGL. See Appendix B. There are multiple towers located within 315 meters of the site. The ground surrounding the site does not rise significantly.

Figure 1 is a site plan of the facility. Attention was focused on the following areas.

- The public access parking lot 22-meters west of the proposed site.
- The two-story building 57-meters WNW of the site.

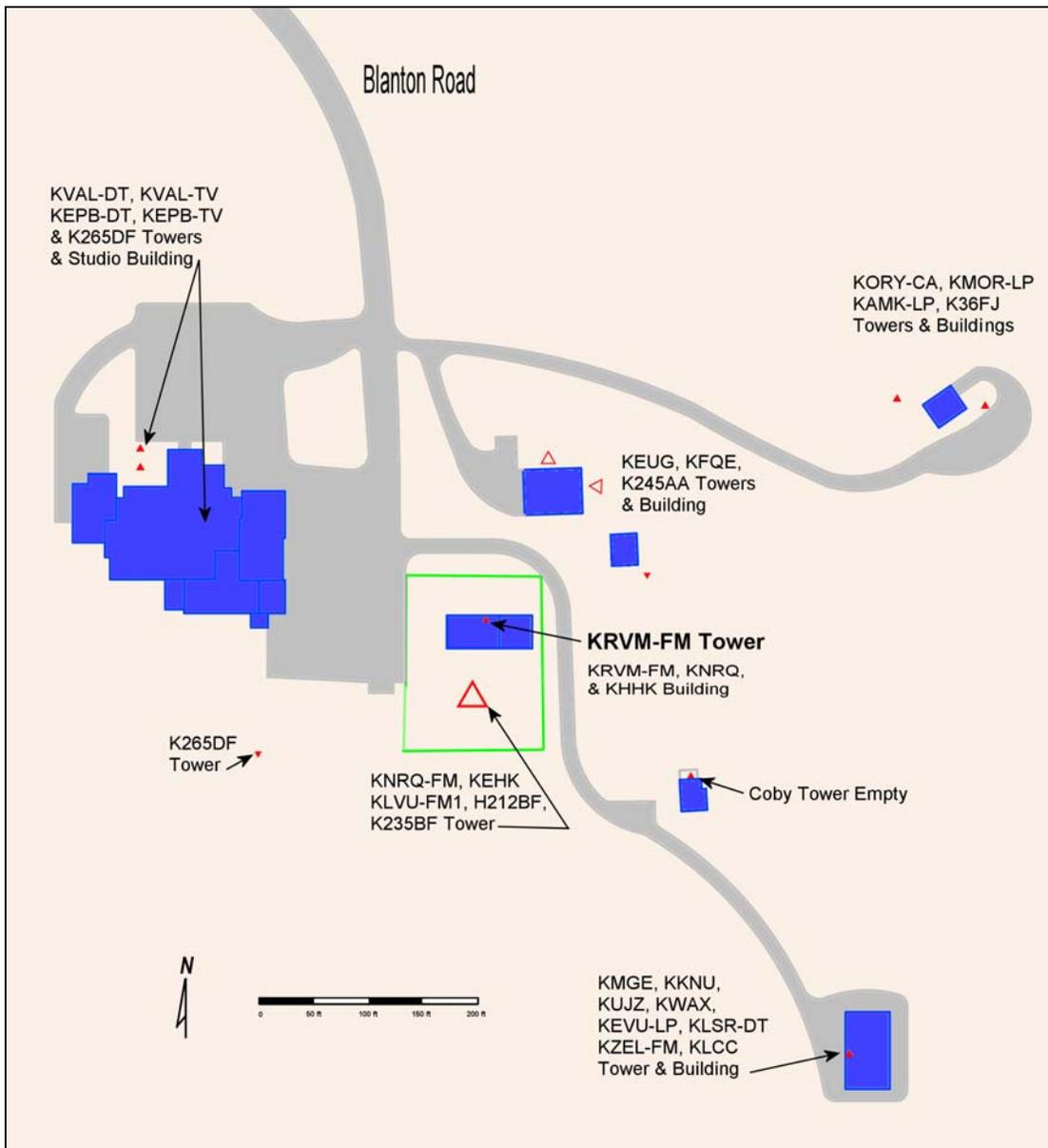


Figure 1. Site Plan.

## *RF Sources*

One RF source was modeled in this analysis. The facility was modeled as an omni-directional source with a maximum ERP (Vertical + Horizontal) of 44,000 Watts operating on 91.9 MHz.

Appendix A contains the antenna vertical plane radiation pattern information. Appendix B contains details of the proposed antenna

Other rf sources located within 315 meters of the tower were not modeled. However, field measurements were recently taken in the area by the consulting firm of Hatfield & Dawson. Appendix C contains a copy of their report. The highest measurements reported in this survey were along a fence-line located between 22 and 28 meters from the proposed facility. The peak value was 63% of the maximum guideline for general population/uncontrolled exposure. It is assumed then that if the contribution by the proposed facility does not exceed 37% of the maximum allowed level then the site will remain in compliance with FCC guidelines.

It should be noted that contributions by the old, full-wave spaced, antenna were not deducted from the measured values.

## *Limits of Exposure*

The limits of exposure for this rf Source are as follows:

- **General population/uncontrolled** 200  $\mu\text{W}/\text{cm}^2$ .
- **Occupational/controlled** 1000  $\mu\text{W}/\text{cm}^2$ .

## *General Population/Uncontrolled Exposure*

Ground level and roof-top power density calculations were performed for a plane perpendicular to, and two meters above, the test surface. A power factor of 2 was used to account for ground reflections.

The peak rf density is predicted to occur at a distance of 155.4 meters from the proposed site. The predicted maximum value is 27.14  $\mu\text{W}/\text{cm}^2$ . This value is approximately 13.6% of the maximum permissible exposure. Predictions using the FCC's "FMmodel" program produced slightly lower predictions. See Figure 2.

The peak rf density along the western border fence-line is predicted to be 11.9  $\mu\text{W}/\text{cm}^2$ . This is approximately 6% of the maximum permissible exposure.

There is a two-story building located approximately 60-meters west of the proposed facility. The peak rf density on this roof-top is predicted to be 17.9  $\mu\text{W}/\text{cm}^2$ . This is approximately 8.9% of the maximum permissible exposure.

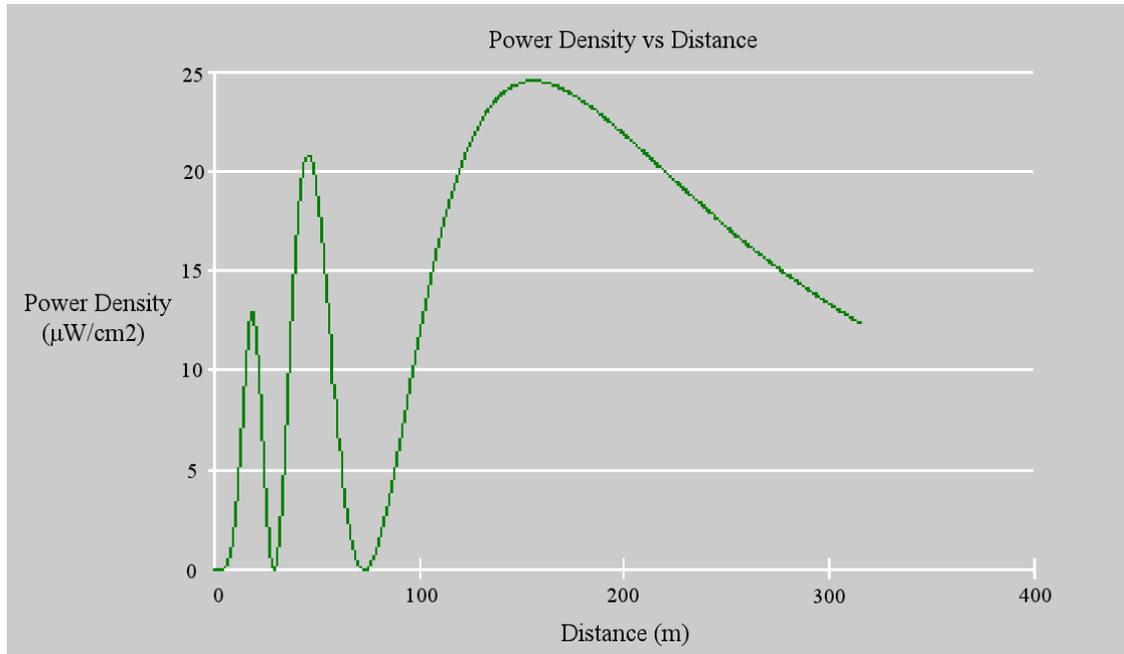


Figure 2. Predicted RF Power Density

### *On-Tower Occupational Exposure*

Calculations indicate that the maximum exposure on the roof-top of the KRVM-FM building is less than  $20.0 \mu\text{W}/\text{cm}^2$ . This represents less than 2% of the occupational exposure limit. Calculations for exposure on the tower above the 8-meter roof-top level were not performed.

### Conclusions:

An analysis was performed modeling the RF energy from a proposed facility for KRVM-FM. This analysis was based on data provided by Carl Sundberg of the Lane County School District 4J, a report by Hatfield & Dawson and the FCC.

In performing this analysis it was assumed that all equipment, including but not limited to, antennas, loads, matching and tuning devices and feedlines were properly designed, installed and operated.

The analysis was conducted with careful consideration to OET Bulletin 65, its associated supplements, and good engineering practices.

The results of the analysis are that after the proposed change the existing facility **will not exceed** the general population/uncontrolled maximum permissible exposure limits in any area accessible by the general public. Further, the facility **will not exceed** the occupational/controlled exposure limits on, and in the immediate vicinity of, the tower to a height of 8-meters AGL.

## Certification:

I personally performed all of the engineering used to prepare this report. The information contained herein is true and accurate to the best of my knowledge. The recommendations and conclusions are mine based on the information provided to me.

I am licensed as a Professional Engineer under Chapter 471, Florida Statutes.

Joseph M. DiPietro, P.E.

01 December 2005

Registration Number: 53242

## References:

OET Bulletin 65, Edition 97-01, *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*. Washington, D.C.: Federal Communications Commission Office of Engineering & Technology, 1997. OET Bulletin 65 is available from:  
<http://www.fcc.gov/oet/info/documents/bulletins/#65>

*rfProfiler* v0.8.10, rfSoftware, Inc. 2000-2004

*MPE Calculator* v0.1.3, rfEngineers, Inc. 2004

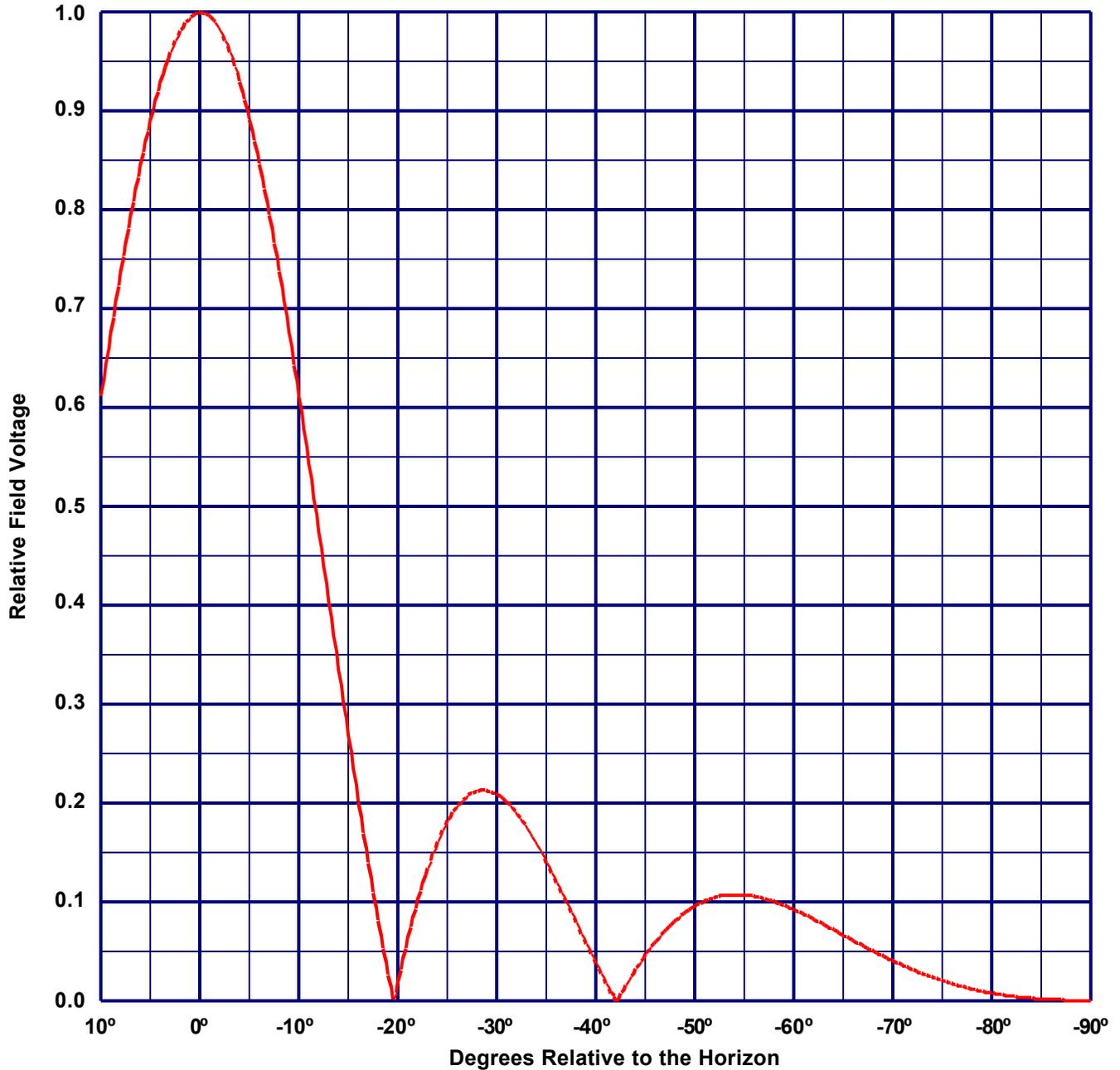
# Appendix A



## Vertical Plane Relative Field Pattern

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

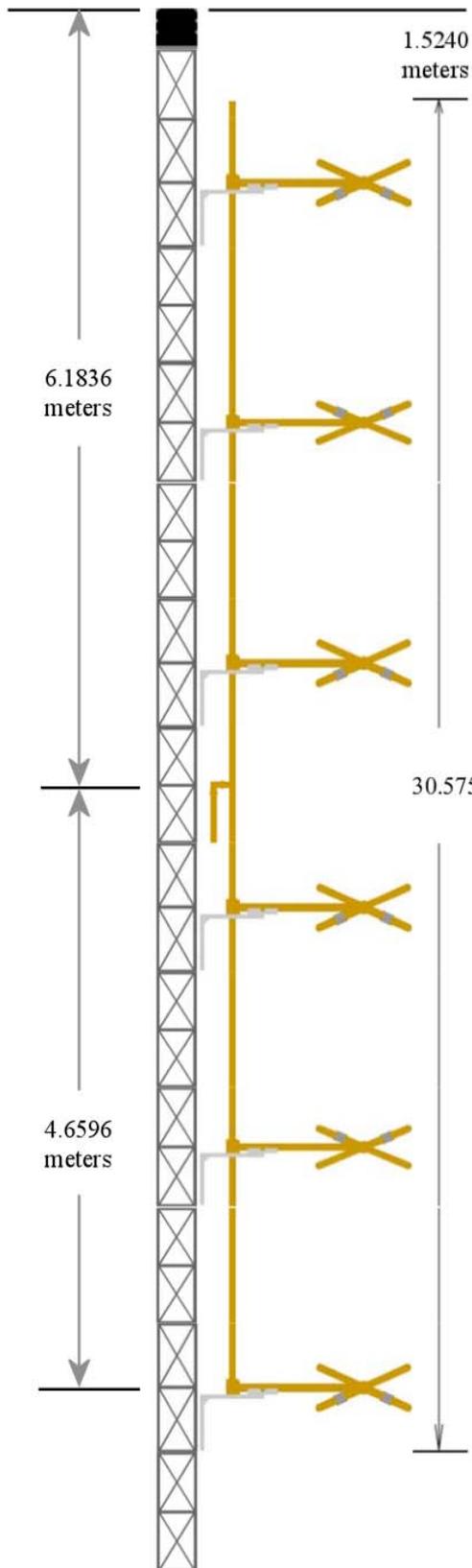
**A 6 level, .5 wave-length spaced non directional antenna  
with 0° beam tilt, 0% null fill and a H/V maximum power ratio of 1.000**



<b>Vertical Polarization Gain:</b>
<b>Maximum: 1.913 (2.817 dB)</b>
<b>Horizontal Plane: 1.913 (2.817 dB)</b>

<b>Horizontal Polarization Gain:</b>
<b>Maximum: 1.913 (2.817 dB)</b>
<b>Horizontal Plane: 1.913 (2.817 dB)</b>

## Appendix B



Antenna Type: SHPX-6AC-HW  
 Frequency: 91.9 MHz  
 Bay Spacing: 63.9825 in.  
 System Length: 30.575 ft. (9.319 meters)  
 Vertical tower space: 41.659 ft.  
 System Gain: 1.913 (2.817 dBdc)  
 ERP: 22 kW (13.424 dBk)  
 Input power: 11.5 kW (10.607 dBk)  
 System Weight: 632 lbs.  
 System CaAa: 24.351 ft<sup>2</sup>.

System CaAa is based on TIA/EIA-222-F Standards

Vertical tower space is based on the top bay mounted 5 feet (1.5240 meters) from the top of the tower. Add 5 feet if the antenna is to be mounted somewhere other than near the top of the tower.

Weight and wind figures do not include radomes or radial ice.

# Appendix C

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## HUMAN RF EXPOSURE MEASUREMENTS

BLANTON HEIGHTS, EUGENE, OR

KMGE(FM), KKNV(FM), KZEL(FM), KLCC(FM)  
KWAX(FM), KUJZ(FM), KLSR-DT, KEVU-LPTV

KEPB-TV & DT, KVAL-TV & DT

KEHK(FM), KNRQ(FM), KRVM(FM)  
KMOR-LPTV, K245AA, K212BF, K265AK

KEUG(FM), KQFE(FM)

AUGUST 16, 2005

## INTRODUCTION

On August 16, 2005, starting at 9:30 AM, ground level radio frequency exposure measurements were made at Blanton Heights near Eugene, OR. Stations upon which measurements were made included KMGE(FM), KKNV(FM), KZEL(FM), KLCC(FM), KWAX(FM), KUJZ(FM), KLSR-DT, KEVU-LPTV, KEPB-TV & DT, KVAL-TV & DT, KEHK(FM), KNRQ(FM), KEUG(FM), KQFE(FM), KRVM(FM), KMOR-LPTV, K245AA, K212BF, K265AK . KEPB was operating at 50% of authorized power on channel 28 NTSC and 4% of authorized power on channel 29 DT, while the other facilities were operating at authorized power when the measurements were made.

## METHODS AND EQUIPMENT USED

A NARDA Model 8718B Electromagnetic Radiation Survey Meter (sn0001) with a NARDA Model B8742D Isotropic Shaped Electric Field Probe (sn05003) was used to make the measurements. The NARDA B8742D probe provides an output proportional to the FCC general public (Uncontrolled Environment) maximum permissible exposure (MPE) over a frequency range from 300 kHz to 3.0 GHz. The isotropic response of the probe is +/-0.75dB. The B8742B probe was calibrated June 1, 2005.

The areas to be measured were scanned with the probe and spatially averaged measurements were made at the locations where peak fields were found. Spatially averaged readings were taken from ground level to two meters above the ground.

MEASURED FIELDS 4585 BLANTON ROAD: KMGE(FM), KKNV(FM), KZEL(FM), KLCC(FM), KWAX(FM), KUJZ(FM), KLSR-DT, KEVU-LPTV

The highest spatially averaged measured plane wave equivalent power density within the area of the fence surrounding this site was less than 20% of the FCC general public MPE limit. The highest measured spatially averaged power density near any guy wire on this site was 28% of the FCC general public MPE limit.

MEASURED FIELDS 4555 BLANTON ROAD: KEHK(FM), KNRQ(FM), KRVM(FM), KMOR-LPTV, K245AA, K212BF, K265AK

The highest spatially averaged measured plane wave equivalent power density was found near the fence at the east edge of the parking lot where 63% of the FCC general public MPE limit was observed.

MEASURED FIELDS 4575 BLANTON ROAD: KEPB-TV & DT, KVAL-TV & DT

The highest spatially averaged measured plane wave equivalent power density found in accessible areas in the vicinity of the KEPB-TV & DT and KVAL-TV & DT facilities was less than 10% of the FCC general public MPE limit.

MEASURED FIELDS 4535 BLANTON ROAD: KEUG(FM), KQFE(FM)

The highest spatially averaged measured plane wave equivalent power density found in accessible areas in the vicinity of the KEUG(FM), KQFE(FM) facilities was less than 5% of the FCC general public MPE limit.

## CONCLUSION

The measurements demonstrate that the transmitting facilities of KMGE(FM), KKNV(FM), KZEL(FM), KLCC(FM), KWAX(FM), KUJZ(FM), KLSR-DT, KEVU-LPTV, KEPB-TV & DT, KVAL-TV & DT, KEHK(FM), KNRQ(FM), KEUG(FM), KQFE(FM), KRVM-FM, KMOR-LPTV, K245AA, K212BF, K265AK on Blanton Heights, (with KEPB-DT & KEPB-TV at reduced power), comply with FCC public exposure guidelines at the locations where the measurements were made. At no location where measurements were made were the FCC occupational MPE limits exceeded.

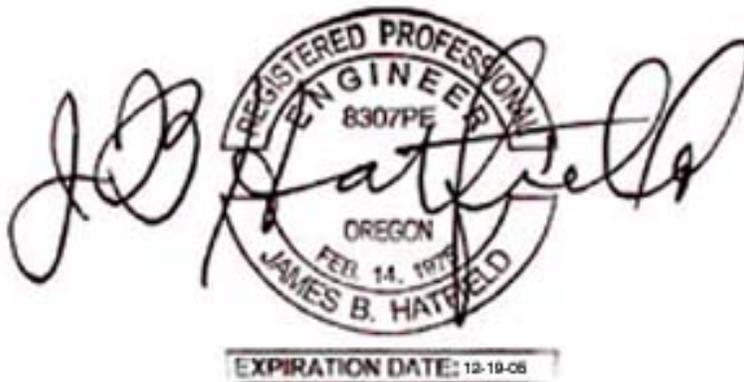
The conclusions of this report are based upon the Commission's environmental requirements in 47 CFR §1.1307. The KMGE(FM), KKNV(FM), KZEL(FM), KLCC(FM), KWAX(FM), KUJZ(FM), KLSR-

DT, KEVU-LPTV, KEPB-TV & DT, KVAL-TV & DT, KEHK(FM), KNRQ(FM), KEUG(FM), KQFE(FM), KRVM-FM, KMOR-LPTV, K245AA, K212BF, K265AK transmitting facilities on Blanton Heights, (with KEPB-DT & KEPB-TV at reduced power), will not have a significant environmental impact as defined by §1.1307, which includes consideration of the exposure of workers or the general public to levels of Radio Frequency radiation exceeding guidelines issued by the American National Standards Institute, the Federal Communications Commission, and the National Council on Radiation Protection and Measurements.

#### ENGINEERING STATEMENT

The measurements and this report were made and written, respectively, by James B. Hatfield, P.E. who states that the information contained herein is true and accurate to the best of his knowledge.

August 23, 2005



The image shows a circular professional seal for James B. Hatfield, a Registered Professional Engineer in Oregon. The seal contains the following text: "REGISTERED PROFESSIONAL ENGINEER", "8307PE", "OREGON", "FEB. 14, 1977", and "JAMES B. HATFIELD". A handwritten signature of James B. Hatfield is written across the seal. Below the seal is a rectangular stamp that reads "EXPIRATION DATE: 12-19-08".

James B. Hatfield, P.E.