Prometheus Radio Project

Subject: KOWS-LP compliance with non-ionizing elctromagnetic radiation (NIER) standards
Date: December 22, 2015

KOWS-LP, Occidental Arts and Ecology Center, holds an FCC construction permit pursuant to FCC application BMPL-20150828ABW which authorizes them to broadcast 25 watts at 92.5 MHz from a 4-Bay OMB MP-4 FM antenna located in Sebastopol at coordinates 38 23 0.83 N 122 49 59.95 W (NAD83).

This report demonstrates that KOWS-LP complies with NIER RF exposure standards specified in Federal statute **47CFR§1.1310** at the antenna site and at nearby homes.

1 - NIER Standards for Maximum Exposure

The Federal Communications Commission offers information and resources regarding NIER, which in FCC terminology is called "**RF Safety**". It is efficient to quote at length from the instructions for KOWS-LP's low-power FM FCC application, FCC Form 318, http://www.fcc.gov/Forms/Form318/318.pdf: [emphasis added]

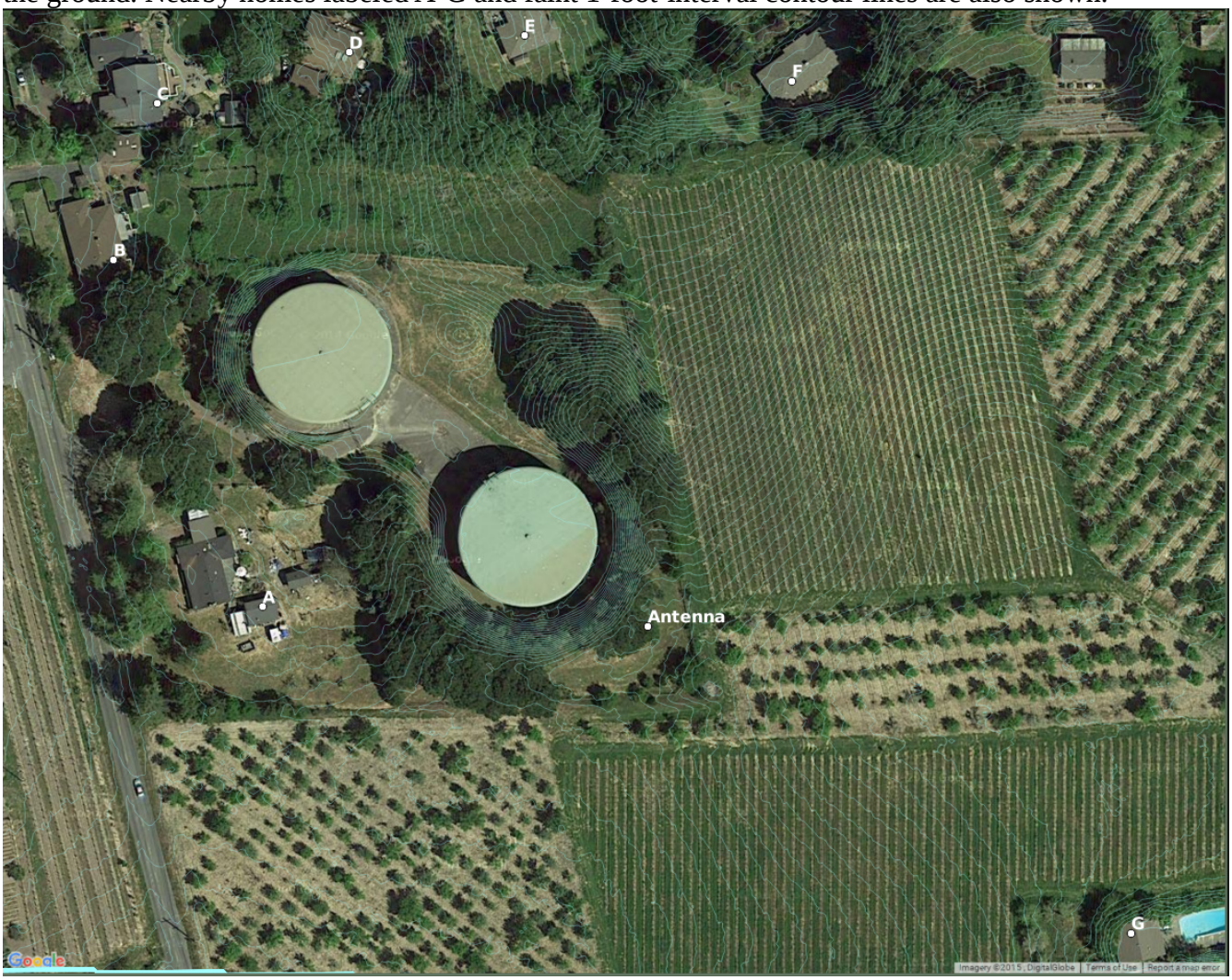
> **RF Exposure Guidelines**. In 1996, the Commission modified its guidelines and procedures for evaluating environmental effects of RF emissions. All LPFM station applications subject to environmental processing must demonstrate compliance with the new requirements. The new guidelines are explained in more detail in OET Bulletin 65, entitled *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Edition 97-01*, released August, 1997, and *Supplement A: Additional Information for Radio and Television Broadcast Stations* (referred to here as "OET Bulletin 65" and "Supplement A," respectively). Both OET Bulletin 65 and Supplement A can be viewed and/or downloaded from the FCC Internet site at http://transition.fcc.gov/oet/rfsafety/

For FM broadcast frequencies, Supplement A states that the exposure safety limit for "**general population/uncontrolled exposure is 0.2 mW/cm² (200 µW/cm2) and the limit for occupational/controlled exposure is 1 mW/cm² (1000 µW/cm2)**".

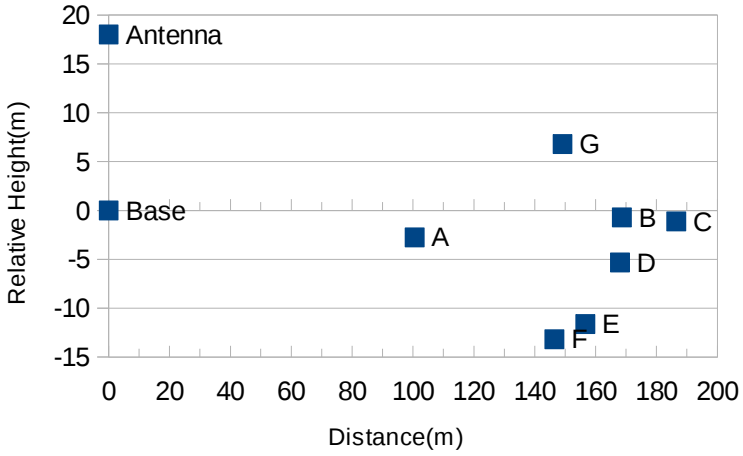
OET Bulletin 65 is the practical implementation of the controlling statute, **47CFR§1.1310 - Radiofrequency radiation exposure limits**.

2 – Site Details

KOWS-LP is approved by the FCC to construct an antenna near Blackney Rd and Pleasant Hill Rd, just southwest of the southern water tank shown below, centered at 18 meters (approximately 60 feet) above the ground. Nearby homes labeled A-G and faint 1-foot-interval contour lines are also shown.



The graph below shows the distance (meters) to each house from the antenna and the elevation of each house (meters) relative to the base of the antenna. Both the antenna base and antenna itself are shown on the left.



3 – Existing NIER Demonstration to the FCC

LPFM applicants must demonstrate compliance with NIER RF Safety standards, and KOWS-LP indicated their compliance by checking Yes to box 10 in their LPFM (FCC form 318) construction-permit application:

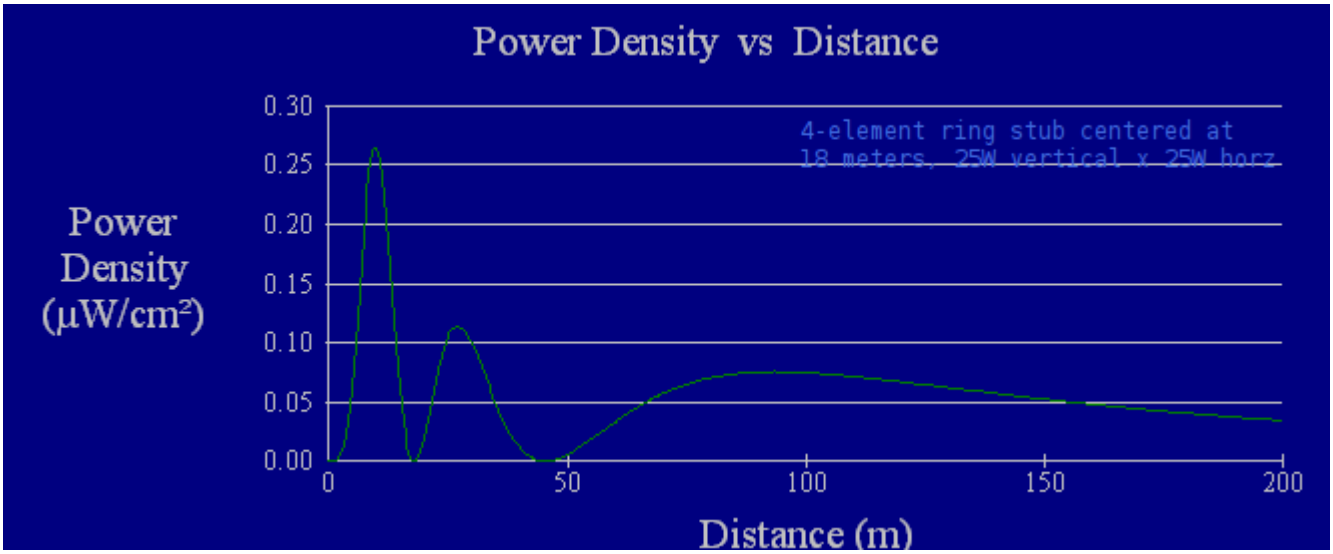
10.	**National Environmental Policy Act.** The applicant certifies, based on its completion of Worksheets 2 and 3 and its review of the instructions to this application, that the proposed facility is excluded from environmental processing under 47 C.F.R. Section 1.1306 (i.e., the facility will not have a significant environmental impact and complies with the maximum permissible radiofrequency electromagnetic exposure limits for controlled and uncontrolled environments). Unless the applicant can determine compliance through the use of the attached General Environmental and RF Exposure Worksheets, an **Exhibit is required.**	(•) Yes ( ) No See Explanation in [Exhibit 14]

A goal of the LPFM radio service is accessibility, which means attempting to unburden applicants – usually small community groups – from purchasing expensive radio engineering services. To this end, the LPFM application offers a simplified method for RF safety NIER compliance. KOWS-LP utilized the simplified method and was approved by the FCC.

4 – Exposure Calculations

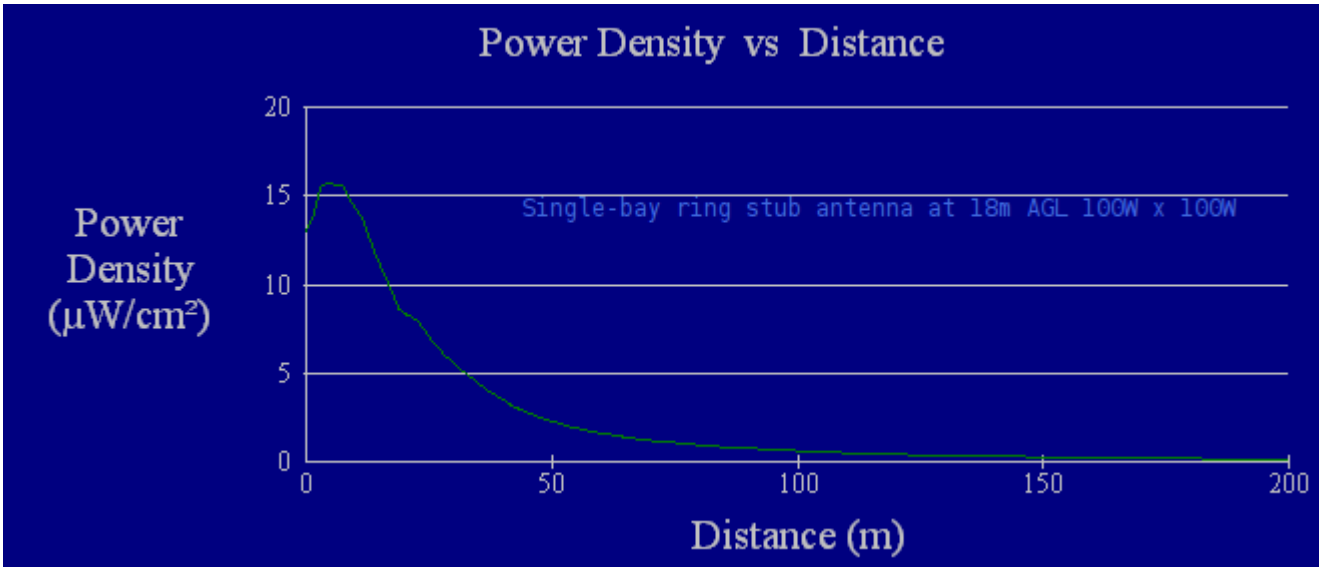
In situations requiring more sophisticated NIER field calculations, the FCC's “FM Model” software, originally developed by the EPA, is normally utilized. FM Model predicts the power density around an antenna given the antenna model, height, and radiated power.

The figure below shows the radiation intensity that would be experienced by a person (assumed to be 2 meters tall) standing at the elevation of the base of KOWS-LP's antenna as currently approved by the FCC.



The maximum exposure level for people in the vicinity of this antenna is less than 0.30 µW/cm$^{2.}$. **This is less than 1% of the more-stringent exposure limit of 200 µW/cm^2, therefore this installation meets NIER requirements.**

Alternatively KOWS-LP may choose a single-bay directional antenna at the same height. In order to estimate the worst-case directional-antenna exposure, FM Model is configured for a single-bay omnidirectional “ring-stub” antenna at the same center height. The FCC would allow up to 50 watts in this situation and location, yet to obtain a more conservative worst case, FM Model is configured for 100 watts, which is incidentally the maximum power allowed for LPFM stations.



Radiation exposure for this artificial worst case is nearly 10 times worse than the currently-approved antenna, yet still well within regulation.

Maximum power density of approximately 16 µW/cm^2 would be experienced by a person standing in the vicinity of the base of the antenna. **This is less than 8% of the more-stringent exposure limit of 200 µW/cm^2, therefore a directional single-bay antenna would also easily meet NIER requirements.**

The safety of workers at the top of the nearby water tank must also be considered. Utilizing FM Model and estimating the top of the water tank as 40 feet higher than the base of the antenna, the predicted exposure according to the worst case above is 112 µW/cm^2. **This is 56% of the more-stringent exposure limit of 200 µW/cm^2, meeting NIER requirements.**

5 – Exposure at Nearby Homes

FM Model was used to estimate the exposure of people outdoors at the locations of the nearby homes labeled previously A through F. Note that the indoor exposure will be less due to attenuation by walls and roofs. Considering both the distance to each home and its height relative to the base of the antenna, and using the artificial worst case, the predicted exposures are listed below.

Home	Distance (meters)	Relative Height (meters)	Exposure µW/cm²	% of Limit
A	100.6	-2.8	0.21	0.1%
F	146.5	-13.2	0.29	0.1%
G	149.1	6.8	0.30	0.2%
E	156.6	-11.6	0.26	0.1%
D	168.0	-5.3	0.23	0.1%
B	168.6	-0.7	0.23	0.1%
C	186.5	-1.1	0.19	0.1%

In all cases, exposure to non-ionizing electromagnetic radiation due to an artificial worst-case KOWS-LP radio station, at the locations of the nearby homes, is less than 1/500th of the stringent NIER limit, and estimated at less than 1/3000th of the limit if the presently-authorized antenna were in use rather than the worst case.

The effects of electromagnetic radio on humans are unlikely to be fully understood at this time and these safety limits may well change as research proceeds, nevertheless the limits are based on the accepted best practices at this time. Anecdotal stories of low rigor and blatant misinformation about radiation exposure abound on the internet, by parties on all sides of the issues. Let the reader beware.

Additional FCC references:

- FAQ http://transition.fcc.gov/oet/rfsafety/rf-faqs.html#Q17
- Main page https://www.fcc.gov/general/radio-frequency-safety-0
- *Questions and Answers about Biological Effects and Potential Hazards of Radio frequency Electromagnetic Fields http://www.fcc.gov/encyclopedia/oet-bulletins-line#56*

6 – Recommendations

1. Offer as a courtesy to reduce power when work is to be performed on the antenna or upon the nearest water tank.
2. Post a caution sign at the antenna tower and provide mechanical discouragement to casual climbers.

Radio professionals in the course of their job are governed by the much higher occupational exposure limit of 1,000 µW/cm² .

Prometheus Radio Project

The calculations in this report were made by myself, Paul Bame, Engineering Director at the Prometheus Radio Project. I am an experienced radio engineer and have prepared many engineering exhibits accepted by the FCC. I affirm that the information and calculations herein are true to the best of my knowledge.

Paul Bame, Engineering Director, Prometheus Radio Project