Columbus, Montana
Translator Application for
Minor Modification
August 2004

Statement of Electromagnetic Radiation Exposure Compliance

The proposed television translator operates with an output power of 100 (one hundred) watts. A Kathrein/Scala Model 1x2K723147 dual-panel off-the-shelf antenna has a gain of 8.5 dBd. Its center of radiation is located 8.7 m AGL.

The site for the proposed translator is located on the north side of "C" hill near Columbus, MT roughly 10 m above the valley floor, on private fenced land used for livestock pasture and forest products. "C" Hill rises sharply south of the site some 120 m in elevation above the site. There is little to no radiation proposed to the south. Terrain falls away sharply northward from the proposed antenna location in the directions of radiation.

The site will house two 100-watt UHF television translators, both sharing the same antenna. Thus, the total effective radiated power will be 1.552 kW, and this will be the basis of further calculations.

Calculations:

At an operating frequency of 540 MHz, power density limits for occupational exposure are calculated as specified in CFR §1.1310(A).

$$[F_{MHz}/300] \text{ mW/cm}^2, \text{ or } [F_{MHz}/0.3] \mu\text{W/cm}^2$$

Maximum limit occupational/controlled 1,800uW/cm^2 @540 MHz

At an operating frequency of 540 MHz, power density limits for uncontrolled/public exposure are calculated as specified in CFR Part 1, §1.1310(B).

$$[F_{MHz}/1500] \text{ mW/cm}^2, \text{ or } [F_{MHz}/1.5] \text{ uW/cm}^2$$

Maximum limit for general population/uncontrolled 360 uW/cm^2 @540 MHz

Exposure was calculated using the following formula (OET-65, Edition 97-01, August 1997):

$$S = \frac{2.56 * 1.64 * 10^5 * F^2 * (P_{ERP})}{4 * \pi * D^2}$$

where S = *power density in uW/cm*^{2}
P_{ERP} = *total ERP (all polarizations) in kilowatts*
F = relative field factor at the direction to the actual point being calculated.
D = Distance from center of radiation to the point being calculated, in meters
2.56 = increase in power density due to ground reflection, assuming a reflection coefficient of 1.6 (1.6 x 1.6 = 2.56).
1.64 = gain of half-wave dipole over isotropic radiator.
10^5 *= Factor in numerator converts to desired units of power density.*

Public Exposure to Translator Radiation:

The closest distance the public can get to the transmit antenna's center of radiation is approximately 150 meters due to the presence of an electric and woven wire fence around the parcel of land on all four sides, plus a gravel precipice on the north side of the property that prevents all but the most foolhardy from approach. Gate access to the site is watched by tenants renting mobile home space near it. Still, for those who do not respect private property boundaries and for the land owner, radiation density was calculated in increments of 5º from vertical, yielding a maximum power density of 65.8 $\mu W/cm^2$ at -20º from horizontal, well below the maximum 360 $\mu W/cm^2$ allowed for uncontrolled public exposure.

Occupational Exposure to Translator Radiation:

The head of a worker 6 feet tall standing at the base of the tower supporting the antenna would be about 5.7 meters below the center of radiation. At this location, the worst-case relative field factor is 0.2. Using this value in the previous equation results in a worker exposure level of 46.2 $\mu W/cm^2$, well below the exposure limit of 1,800 $\mu W/cm^2$.

Any work on the antenna or tower would be performed with the translators powered off.

Additional Major Sources of Radiation:

The only other known source of non-ionizing radiation in the general area is the Western Wireless cellular site, located 3.62 km WNW of the proposed translator site. This site hosts a 100-watt UHF television translator, a 100-watt FM translator, public safety radio systems, and cellular communications facilities, none of which will contribute in any significant way to potential radiation exposure at the proposed site.

Statement of Radiation Compliance:

Algebraically adding all major sources of radiation at the site yields these peak exposure levels at ground level:

The public – maximum 65.8 $\mu W/cm^2$, below the limit of 360 $\mu W/cm^2$.

Workers on the ground at the site – 46.2 $\mu W/cm^2$, well below the limit of 1,800 $\mu W/cm^2$.