# Exhibit 3
# Radiation Hazard Analysis
# Tecom/Qest Antenna

This exhibit presents the radiation hazard analysis for Row 44 using the FCC procedure outlined in FCC Bulletin #65. The limit for exposure to RF energy, for frequencies greater than 1.5 GHz, is 5 $mW/cm^2$ for up to a 6 minute duration (occupational/controlled exposure) and 1 $mW/cm^2$ for up to a 30 minute duration (general population/uncontrolled exposure).[1]

Analysis for exposure to radiation is presented for the near field, far field and the transition region. Safe limits are computed for the controlled and uncontrolled exposure for both the antenna main beam and sidelobes.

The near field region for the main beam is defined in terms of the radius $R_{nf}$ according to the relation

$$R_{nf} = D^2/4\lambda$$

where D is the antenna panel width and $\lambda$ is the transmit wavelength. The near field maximum power density, $S_{nf}$, is determined from

$$S_{nf} = P_{PA}/A$$

where $P_{PA}$ is the transmit power (after cable losses are accounted for) and A is the surface area of the antenna panel. With an antenna height h, the surface area A=Dh

The far field region for the main beam is defined in terms of the radius $R_{ff}$ given by

$$R_{ff} = 0.60\ D^2/\lambda$$

The far field power density $S_{ff}$ at the minimum far field radius is given in terms of the EIRP denoted by $P_{EIRP}$ according to

$$S_{ff} = P_{EIRP}/4\pi\ R_{ff}^2$$

When the radius is expressed in meters, the power densities are $w/m^2$. The results are converted to $mW/cm^2$ by multiplying the power densities in $w/m^2$ by 0.1.

***Near Field Exposure from Main Antenna Beam***

[1] "Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields," Federal Communications Commission, Office of Engineering and Technology, Bulletin 65, Fourth Edition, August, 1999, p.15.
http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet56/oet56e4.pdf

The Tecom/Qest antenna has dimensions D=0.625 m (24.6") and h=0.157 m (6.2") and a surface area A=0.098$m^2$. At the highest transmit frequency of 14.5 GHz, the wavelength is 0.0207 m. The near field radius is then

$R_{nf}$ = 4.72 m

Since the maximum transmit power is $P_{PA}$=10 watts, the maximum power density in the near field is

$S_{nf}$ = 10.2 mW/$cm^2$

***Far Field Exposure from Main Antenna Beam***

Based on the wavelength and panel width given above, the far field radius is then

$R_{ff}$ = 11.3 m

The maximum EIRP is 38.8 dBW resulting in a far field power density of

$S_{ff}$ = 0.47 mW/$cm^2$

***Transition Region Exposure from Main Antenna Beam***

Assuming that the field density decrease linearly from $S_{nf}$ = 10.2 mW/$cm^2$ to $S_{ff}$ = 0.47 mW/$cm^2$, then the 5 mW/$cm^2$ power density for controlled exposure occurs at a distance of 8.25 meters

For the case of the 1 mW/$cm^2$ power density for uncontrolled exposure the safe distance is 11 meters.

Based on antenna sidelobes with 12 dB reduction from the main beam and using the far field expressions, no individual in a controlled exposure should be within 0.9 meters ( ~3 feet) of the antenna while it is transmitting and for no longer than 6 minutes. The 30 minute exposure range for an uncontrolled exposure due to sidelobes is 2 meters ( ~6.6 feet).

<u>*Summary*</u>

This document presents the radiation hazard analysis for Row 44's system incorporating the Tecom/Qest antenna and the maximum EIRP of 38.8 dBW. Individuals in a controlled exposure should be at least 8.25 meters (27 feet) away from the antenna and for no more than 6 minutes and in an uncontrolled exposure should be at least 11 meters (36 feet) away for 30 minutes, if they are in the main beam of the antenna.