

Notes of T-mobile Westmont Tower RF Radiation Analysis

The standard FCC OET Bulletin 65 methodology was used in the analysis. The contours are a bit more sophisticated than sometimes seen as propagation modeling software was used to determine the “look angle” to the tower based at each point based on the distance from the tower and neighborhood topography.

For example, at a location in the 30 feet away from the tower on level ground, one would have a look angle of 45 degrees to the antenna (atan 30 feet/30 feet). Due to the radiation pattern of the tower’s antennas, there is very little energy radiated at a 45 degree elevation angle. For this reason, there is no high power RF immediately around the tower.

As another example, at a distance of 100 feet from the tower, the look angle is much shallower, thus putting the location within the main lobe of radiation in the elevation plane. This is particularly true as the topography is also used in the calculations. The elevated school playground makes the look angle even shallower.

The equation below is from OET-65 and forms the basis of all calculations. In the examples above, the term “G” (antenna gain) changes as a function of distance and elevation (i.e. the look angle) based on the antenna’s radiation patterns. Antenna gain also changes as a function of azimuth angle, thus producing the three-lobes seen in the contours. Of course, “R” also changes based on distance thus reducing exposure at greater distances.

$$S = \frac{PG}{4\pi R^2} \quad (3)$$

where: S = power density (in appropriate units, e.g. mW/cm²)
P = power input to the antenna (in appropriate units, e.g., mW)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

If there is a weakness in the analysis, it is not the power density equation methodology but the assumptions used regarding the cell tower. Assumptions were made regarding the antenna radiation patterns and antenna gain based on the physical dimensions of the antenna panels. This is the best that can be done without knowing the specific antenna manufacturer and model number. The antennas on the tower were compared to various models available along with the use of standard antenna directivity equations to estimate performance. The exact model used on the tower was not located in the manufacturer catalogs reviewed.

Assumptions were also made regarding the power fed to the antennas and the duplexing arrangements. It was assumed that all antenna ports are being fed (duplex mode) with a

power of 40 Watts each leading to an Effective Isotropic Radiated Power (EIRP) of 1000 Watts at the peak of the antenna radiation pattern. This value was used as it is the maximum allowable before the FCC requires additional analysis/licensing. Based on a review of other macro-cell towers where information is public, it is probably a reasonable assumption that they go right up to the limit.

If T-mobile provides the actual information, the exposure contours can easily be recalculated, along with an update of the analysis. This is the reason assumptions were specifically included in the analysis and right at the top of the analysis it was stated that assumptions had to be made since T-mobile had not provided the info.

The purpose of this analysis is bound what is now an unknown. If incorrect assumptions were made, then T-mobile should provide the actual values so the contours can be recalculated. If T-mobile doesn't respond, then it would appear that they don't dispute the assumptions used.

Please also keep in mind that although I'm a comm systems engineer, I'm not a registered engineer that can provide a certified affidavit. Even if I could, it is clear that they do comply with existing federal law regarding exposure. However, the fact remains that residences and the schoolyard are subjected to RF levels above that allowed in other countries and that these levels have been associated with deleterious health effects.

Engineering assumptions from the analysis copied below for completeness.

Site

Tower height: 28 feet AGL to antenna center
Height above ground level for exposure contours:
13 feet (simulate 2nd floor or residences)

Antenna

Quantity: Six
Type: Panel
Pattern: 92 deg Azimuth HPBW, 14 deg Elevation HPBW
Gain: 14.0 dBi
Polarization: Dual Linear
Azimuth Orientation: 63 deg, 182 deg and 240 deg
Elevation tilt: None

Transmitter

Frequency: 1900 MHz (assume PCS GSM)

Drive: 40 Watts per antenna port (EIRP 1000 W maximum)

Additional note: based on the presence of duplexers and/or diplexers on the tower and cross cabling between panels, it is assumed that each antenna port is being fed the full 40 Watt power to the 1000 Watt EIRP maximum. In each direction, there are two antenna panels, each with two ports (dual linear polarization). This leads to a fed power of 160 Watts in each of the towers radiation "lobes". This would be the most effective use of the tower's resources.

However, it is possible that all ports are not being used in full duplex mode, with half of the ports being used in a receive-only mode. This would reduce the fed power to 80 Watts per lobe, thus leading to reduction in the contour distance of 70.7% of the distance shown.

If T-mobile were to provide their link budgets and system block diagrams, these questions could be conclusively answered.