Prince George's County
RF Compliance Assessment Report

PREPARED FOR THE

TELECOMMUNICATIONS TRANSMISSION FACILITY COORDINATING COMMITTEE (TTFCC)

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BY

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COMMUNICATIONS
ENGINEERING & ANALYSIS
FOR THE PUBLIC INTEREST

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Table of Contents

Tables

1. Introduction and Summary

At a November 6, 2007 briefing before the Prince George's County Council, Columbia Telecommunications Corporation (CTC), the Facility Coordinator for the TTFCC, was asked to prepare a report to 1) provide information about the Federal Communications Commission (FCC) limits for human exposure to RF electromagnetic fields, 2) estimate the typical RF exposure for a telecommunications site in the County, and 3) state the steps taken in the TTFCC review process to assure compliance with FCC limits.

This report reviews the FCC limits and the estimated RF exposure from a typical monopole. We selected the monopole located at 555 Hill Road in Landover as our example. This monopole currently supports directional panel antennas from four service providers including Cingular, T-Mobile, Nextel, and Verizon Wireless. The calculations are based on the information provided by each carrier in their TTFCC application for antennas mounted on this monopole at the 98', 78', 67' and 55' above ground levels.

This report provides the following:

- Assessment of an antenna site compliance with the FCC limit for maximum permissible exposure (MPE), a limit established as safe for continuous human exposure to RF fields;
- Relevant technical data on each of the four cellular service providers;
- FCC mathematical model for assessing compliance with the MPE limit; and
- Analysis of the results of the calculations and the compliance conclusion for this site.

Appendix A provides excerpts from the TTFCC application related to the TTFCC's review of the applicant's compliance with FCC limits for RF exposure.

2. Executive Summary

The findings and conclusions of this report are as follows:

- The Federal Communications Commission has authority for setting and enforcing compliance with the Commission's limits for RF emissions and places the burden of compliance on the carriers to meet the limits.

- The analysis in this report finds that generally, typical cell site "worst case" emissions are less than 1% of the FCC limits at the base of the typical monopole. These values will decrease even more the further one moves away from the monopole. These values are within the rules adopted by FCC which specify that RF emissions should not be in excess of 5% of the exposure limit.

- The TTFCC requires a certification with each application for placing new antennas in the County that they comply with the FCC limits as set in their Rules and Regulations.

3. Antenna and Transmission Data

The key transmission parameters for the four carriers are summarized in Table 1. Note that as per the applications, all cellular operators are known to employ directional panel antennas arranged to achieve sectorized service coverage.

Table 1: Transmission Parameters

Carrier	*Frequency Band(s)*	*Antenna Mounting Height*	*Effective Radiated Power (ERP)*
Cingular	800 MHz and 1900 MHz	98 Feet	166 Watts
T-Mobile	1900 MHz	78 Feet	160 Watts
Nextel	800 MHz	67 Feet	100 Watts
Verizon	800 MHz and 1900 MHz	55 Feet	166 Watts

4. Technical Analysis

The FCC Office of Engineering and Technology Bulletin 65 (OET Bulletin 65) provides guidelines for mathematical models to calculate potential RF exposure levels at various points around transmitting antennas.

The FCC's formula for predicting RF field strength and power density levels around typical RF sources is given by the formula:

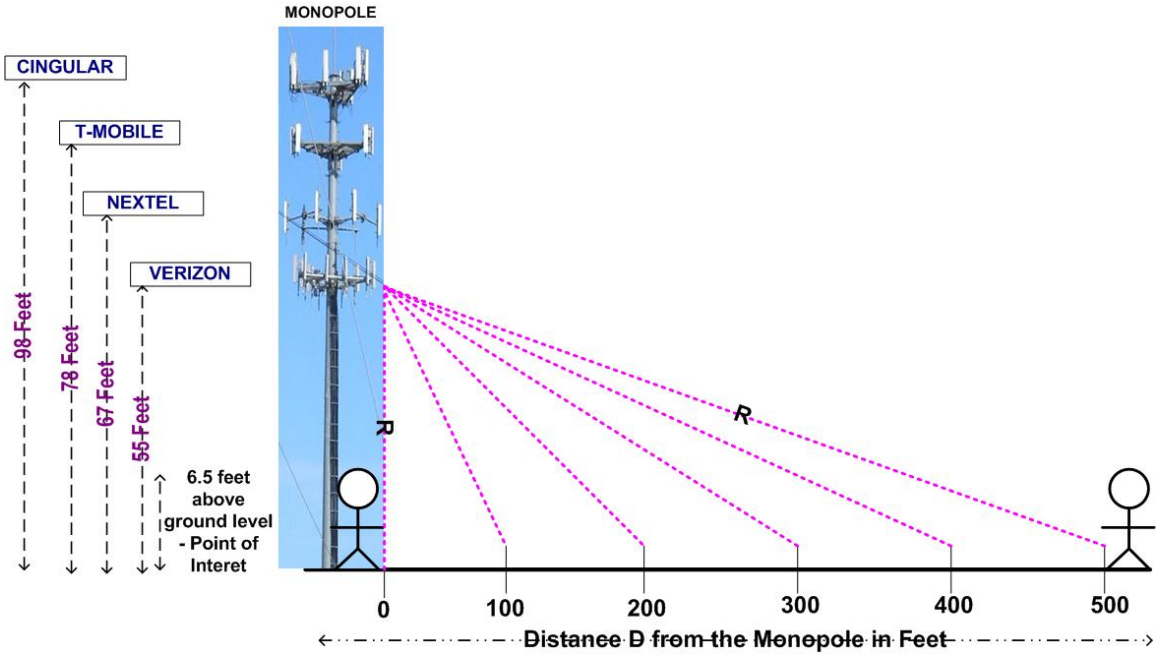
$$S = 1.64ERP / \pi R^2$$

Where;

S = Power density or RF emission in μW/cm^2
ERP = Effective Radiated Power in Watts
R = Distance to the center of radiation of the antenna i.e. at the point of interest in meters

As per OET Bulletin 65, this equation is generally accurate in the far-field of an antenna and provides "worst case" or conservative prediction in the near-field. This equation also assumes 100% reflection of incoming radiation. Thus, it is the true "worst case" prediction of ground level MPE.

The calculations are performed out to a distance of 500 feet from the monopole to points 6.5 feet (approximately two meters, the FCC-recommended standing height) off the ground, as illustrated in the diagram below.



The following conservative methodology and worst case assumptions are incorporated into the MPE calculations. This significantly overstates the calculated RF levels relative to the levels that are actually likely to occur. The purpose of this approach is to allow for safe conclusions of the compliance with MPE limit.

1. The antennas are assumed to be operating continuously at maximum RF power.
2. The directional antennas are assumed to be pointed directly overhead at all points of interest at ground level.
3. The power-attenuation effects due to visual obstruction to a line-of-sight path from the antennas to the points of interest at ground level are ignored.
4. The distance R is minimized by performing the calculations from the bottom (rather than the centerline) of the antenna.
5. The potential RF exposure at ground level is assumed to be 100% via a "perfect" field reflection from the ground itself.

Table 2 provides the results of the MPE calculations for distances out to 500 feet from the monopole.

Table 2: MPE Calculations

1	2	3	4	5	6	7
Distance (Feet)	**Cingular (mW/cm^2)**	**T-Mobile (mW/cm^2)**	**Nextel (mW/cm^2)**	**Verizon (mW/cm^2)**	**Total MPE (mW/cm^2)**	**% of §1.1310 level (Uncontrolled)[1]**
0	0.111	0.176	0.154	0.397	0.00838	0.15697%
100	0.051	0.060	0.041	0.076	0.00227	0.042538%
200	0.019	0.020	0.013	0.022	0.00074	0.013892%
300	0.009	0.009	0.006	0.010	0.00035	0.006568%
400	0.006	0.005	0.003	0.006	0.00020	0.00378%
500	0.004	0.004	0.002	0.004	0.00013	0.002446%

The rules adopted by the FCC specify that, in general at multiple antenna sites, the area in question should not be in excess of 5% of the exposure limit. Column 7 in Table 2 above lists the total percentages of exposure at various distances at ground level stated in Column 1 of the Table. Based on our calculations, even at the base of the monopole the exposure is well below FCC minimum limits in our example.

When performing this evaluation for compliance with FCC RF guidelines, ***all*** significant contributors to the ambient RF environment should be considered. If the total MPE exceeds 5% of the threshold value, it is the shared responsibility of all licensees whose transmitters produce power density levels at the area in question in excess of 5% of the exposure limit.

Table 3 lists the FCC limits for both occupational (controlled) and general population exposures (uncontrolled) for the different radio frequency ranges using the mW/cm^2 reference.

Table 3: FCC Limits for Occupational and General Public Exposure

Frequency Range (F) (MHz)	Occupational Exposure (mW/cm^2)	General Public Exposure (mW/cm^2)
0.3 - 1.34	100	100
1.34 - 3.0	100	180/F^2
3.0 - 30	900/F^2	180/F^2
30 - 300	1.0	0.2
300 - 1500	F/300	**F/1500**
1500 - 100,00	5.0	**1.0**

[1] As per FCC (OET Bulletin 65, §1.1310 level), "Uncontrolled" refers to general public exposure over which there is no control

5. TTFCC Review of FCC Compliance

In its review of each application, the TTFCC requires the applicant to certify that the placement of the antennas complies with the FCC limits. The service provider's engineer is required to certify that the statements in the application are true and accurate. The burden of responsibility of meeting the requirement for FCC limits is appropriately placed on the applicant by the TTFCC, just as is done by the FCC. Enforcement in cases of noncompliance is under the authority of the FCC.

In reviewing each application, the Facility Coordinator checks to ensure that the relevant sections of the application are completed. Based on the conditions of the location where the antennas are to be placed, the Facility Coordinator may inquire if a cumulative RF analysis has been performed, and if not, may request that one be conducted to further document the addition of new antennas will still meet the FCC limits.

6. Conclusion

The calculated RF levels in this case are substantially below the acceptable FCC limit. Again, these calculations are based on a very conservative approach; thus, the actual RF emission is likely to be much lower. As shown in Table 2, it is clear that the RF emission further reduces as you move away from the monopole, and that maximum power density is experienced when you stand exactly below the antennas. As you move further away from the antenna site to as little as 100', the power density due to all the contributors is even lower than the acceptable value of 0.533mW/cm^2 at 800MHz and 1mW/cm^2 at 1900MHz -- the typical cellular operating frequencies. Thus, there is less likelihood of any potential health hazard from RF emissions at the ground level.

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APPENDIX A

Engineering Certification

I hereby certify that all the radio-frequency (RF) information and the statements submitted in this application and any and all subsequent RF submissions or amendments to the application are true, complete and accurate to the best of my knowledge and belief, and are made in good faith.

I further certify that:

1. *The RF engineering has been performed to the best industry and engineering standards.*
2. *The geographical terrain data in determining the expected radio coverage is that provided by the U.S. Geological Survey, and is based on three (3) second or better terrain data.*
3. *No alteration or modification of data has been performed in the preparation of the coverage maps, unless stated in the application package. (i.e., adjust for obstructions unique to the area, foliage loss, etc.)*

I further certify that that individual signing below has authority to act on behalf of the Applicant regarding this certification.

Name: _____
Title: _____
Signature: ___*This must be signed by the carrier's engineer who is responsible for the project.*Date: _____

FCC and FAA Rules & Regulations

Information about this section may be found at the Federal Communications Commission's website: wireless.fcc.gov

Will the antenna installation be in compliance with the maximum permissible RF exposure limits set forth in Sec.1.1310 of the FCC Rules and Regulations?

Yes ☐ No ☐ ***If no***, please attach an explanation.

Type of compliance study required under Sec. 1.1307 of the FCC Rules and Regulations:

Categorically Excluded ☐
Routine Environmental Evaluation ☐
Environmental Assessment ☐

If antennas will be located on a rooftop, please attach a description of any steps that have been or will be taken to prevent the aggregate RF from exceeding exposure limits.

State if an application for an FAA review has been submitted. If an FAA determination for the site has been issued, please attach a copy.

Antenna Information

Type (Please check one.): ☐ OMNI ☐ PANEL ☐ OTHER (specify): _____

Mounting Height (RAD AGL): _____ (ft) Antenna make and model number _____

Antenna Size (a copy of the antenna specifications cut sheet): H_____" W_____" D_____"
A copy of the technical specification sheets for the antennas proposed to be attached at this site. This must be provided with each application and for each type of antenna proposed to be attached to the structure.
Frequency Bands to be used: Tx: _____ Rx: _____

Maximum Effective Radiated Power (ERP): _____