



EVALUATION OF COMPLIANCE WITH GUIDELINES FOR HUMAN EXPOSURE TO RADIO FREQUENCY RADIATION for Clearwire LLC

INTRODUCTION

This engineering statement was prepared to analyze the expected level of Non-Ionizing Electromagnetic Radiation ("NIER") caused by the addition of radio transmission equipment belonging to Clearwire at the following proposed radio frequency transmitter site:

Site Name:	MI-GRP122
Site Address:	3390 Bauer Road
City, State:	Jenison, MI 49428
Coordinates (NAD83):	42-55-8.6 N 85-50-9.9 W

ANALYSIS

In 1985, the FCC adopted the 1982 ANSI guidelines for purposes of evaluating exposure due to RF transmitters licensed and authorized by the FCC. In 1992, ANSI adopted the 1991 IEEE standard as an American National Standard (a revision of its 1982 standard) and designated it ANSI/IEEE C95.1-1992. In 1996, the FCC adopted a modified version of its original proposal. The FCC's action also fulfilled requirements of the Telecommunications Act of 1996 for adopting new RF exposure guidelines. The FCC considered comments submitted by the EPA, FDA, NIOSH and OSHA, which have primary responsibility for health and safety in the Federal Government.

The FCC's guidelines are based on recommended exposure criteria issued by the NCRP and ANSI/IEEE and are similar to the ANSI/IEEE 1992 guidelines except for differences in recommended exposure levels at lower frequencies and higher frequencies, and for controlled and uncontrolled access areas. Over a broad range of frequencies, NCRP exposure limits for the public are generally one-fifth those for workers in terms of power density.

The NCRP and ANSI/IEEE exposure criteria are frequency dependent since the whole-body human absorption of RF energy varies with the frequency of the RF signal. The most restrictive limits on exposure are in the frequency range of 30-300 MHz where the human body absorbs RF energy most efficiently when exposed in the far field of an RF transmitting source. The exposure limits adopted by the FCC in 1996 are shown in Appendix 1. The NCRP and ANSI/IEEE exposure criteria and most other standards also specify "time-averaged" MPE limits. This means that it is permissible to exceed the recommended limits for short periods of time as long as the average exposure (over the appropriate period specified) does not exceed the limit. For example, Appendix 1 shows that for a frequency of 100 MHz the recommended power density limit is 1 mW/cm² with an averaging time of six minutes (any six-minute period) for occupational/controlled exposure.

The Clearwire proposed transmitters operate in the FCC EBS/BRS services and broadcast in the 2500 - 2690 MHz frequency range. In addition, there may be additional point-to-point microwave transmitters operating between 5 and 23 GHz (see Table 1). Therefore, the proposed new transmitters will fall into the 1500-100,000 MHz frequency band for NIER evaluation. The mandated maximum NIER limit for the 1500-100,000 MHz band for a "General Population/Uncontrolled Exposure" area is 1 mW/cm².



Assuming the worst case of an isotropic radiator, the power density for a given radiated power and distance can be calculated from the following formula:

$$S = \text{EIRP}/(4\pi R^2)$$

where

S = Power Density (mW/cm²)

EIRP = Effective Isotropic Radiated Power (mW)

R = Distance from the radiation center (cm)

To account for exposure arising from ground reflections, the calculated power received at a point 6 FT AGL is multiplied by a coefficient of 2.56 as recommended by the Environmental Protection Agency (“EPA”). Therefore, using the forgoing data and formula, the predicted cumulative power density to a human at ground level from all of the existing and proposed radiators located at this facility is calculated as follows:

Environmental Analysis									
Name	MI-GRP122								
Street	3390 Bauer Road								
City, State, Zip	Jenison, MI 49428								
Latitude (NAD83)	42-55-8.6 N								
Longitude (NAD83)	85-50-9.9 W								
Carrier Type	Frequency (MHz)	Worst Case EIRP (dBm)	Number of Simultaneous Channels	Distance To Ground (FT)	Power Flux Density In Free Space (mW/cm ²)	Reflection Coefficient	Power Flux Density Including Reflections (mW/cm ²)	Required Power Flux Density	% of Requirement
Proposed Clearwire MDS	2500	48.00	3	100	0.001835	2.560000	0.004697	1.000	0.47%
Proposed Clearwire Point to Point	18000	58.70	1	96	0.007839	2.560000	0.020069	1.000	2.01%
Proposed Clearwire Point to Point	18000	52.20	1	96	0.001755	2.560000	0.004493	1.000	0.45%
Proposed Clearwire Point to Point	5800	45.20	1	96	0.000350	2.560000	0.000896	1.000	0.09%
Total % Of Requirement									3.02%

Table 1

As shown in Table 1, the cumulative transmissions at this site with the addition of the proposed Clearwire transmissions is well below the 100% limit and no exposure risk should exist.

CERTIFICATION OF ENGINEER

I, James Cornelius, P.E., am a Professional Engineer licensed in the Commonwealth of Virginia and my credentials are a matter of record with the Federal Communications Commission. The foregoing analysis was prepared by me or under my direct supervision. The information contained herein is true and correct to the best of my knowledge.

James Cornelius, P.E.

5-1-2007

Date





Appendix 1

FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz *Plane-wave equivalent power density

NOTE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.