



STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

Ten Franklin Square, New Britain, CT 06051
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VIA ELECTRONIC MAIL

October 18, 2024

Cullen Morgan
Centerline Communications, LLC
750 W Center Street, Suite 301
West Bridgewater, MA 02379
cmorgan@clinellc.com

RE: **EM-VER-078-240910** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 205 Spring Hill Road (a/k/a 230 Clover Mill Road), Mansfield, Connecticut. **Acknowledgement of Complete Request..**

Dear Cullen Morgan:

The Connecticut Siting Council (Council) is in receipt of your correspondence of October 16, 2024, submitted in response to the Council's October 3, 2024 notification of an incomplete request for exempt modification with regard to the above-referenced matter.

The submission renders the request for exempt modification complete and the Council will process the request in accordance with the Federal Communications Commission 60-day timeframe.

Thank you for your attention and cooperation.

Sincerely,

A handwritten signature in dark ink, appearing to read "Melanie Bachman".

Melanie Bachman
Executive Director

MAB/ANM/laf

From: Cullen Morgan <cmorgan@clinellc.com>
Sent: Wednesday, October 16, 2024 11:52 AM
To: CSC-DL Siting Council <Siting.Council@ct.gov>
Cc: Fontaine, Lisa <Lisa.Fontaine@ct.gov>; Christopher Tracy <ctracy@clinellc.com>
Subject: Re: EM-VER-078-240910 -(Clover Mill Road) Mansfield- Council Incomplete Letter

Good Afternoon,
Please see the attached correspondence.

Best,



Cullen Morgan | Site Acquisition Consultant
Mobile: (941)-549-7263
cmorgan@clinellc.com | www.centerlinecommunications.com



**Cellco Partnership d/b/a
Verizon Wireless**

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October 16, 2024

Members of the Siting Council
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

RE: EM-VER-078-240910 - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 205 Spring Hill Road (a/k/a 230 Clover Mill Road), Mansfield, Connecticut. Notice of Incomplete Request. Supplemental Submission.

To Whom It May Concern:

We are in receipt of correspondence (see attached **Exhibit 1**) dated **October 3, 2024**, from the council notifying Verizon that the above-referenced Exempt Modification requests were incomplete and required the submission of additional materials. As per the council's request, please see the following enclosed documents which shall be considered an addendum to, and made a part of, the above-referenced Exempt Modification Request.

1. The revised cumulative far-field Radio Frequency Power Density Analysis is attached hereto as **Exhibit 2**.

If there are any further questions/concerns, please don't hesitate to reach out to me directly.

Respectfully Submitted,
Cullen Morgan
Site Acquisition Consultant
Centerline Communications, LLC
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Mobile: (941)-549-7263

750 West Center Street, Suite 301
West Bridgewater, MA 02379
781-713-4725

EXHIBIT 1

Correspondence Dated October 3, 2024



STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

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VIA ELECTRONIC MAIL

October 3, 2024

Cullen Morgan
Centerline Communications, LLC
750 W Center Street, Suite 301
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cmorgan@clinellc.com

RE: **EM-VER-078-240910** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 205 Spring Hill Road (a/k/a 230 Clover Mill Road), Mansfield, Connecticut. **Notice of Incomplete Request.**

Dear Cullen Morgan:

The Connecticut Siting Council (Council) received a notice of intent to modify the above-referenced facility on September 10, 2024.

According to Section 16-50j-71 of the Regulations of Connecticut State Agencies, "...any modification, as defined in Section 16-50j-2a of the Regulations of Connecticut State Agencies, to an existing tower site, except as specified in Sections 16-50j-72 and 16-50j-88 of the Regulations of Connecticut State Agencies, may have a substantial adverse environmental effect."

Staff has reviewed this exempt modification request for completeness and has identified a deficiency in the radio frequency power density analysis.

On September 23, 2022, the Council issued a memorandum to telecommunications industry representatives requiring a cumulative far-field Radio Frequency Power Density Analysis to be provided with all telecommunications exempt modification requests. The radio frequency emissions report dated August 6, 2024 provided with the request does not include a cumulative far-field analysis. A copy of the memorandum is available on the Council's website at the following link: [20220923-farfieldmemo_final.pdf \(ct.gov\)](https://portal.ct.gov/csc/20220923-farfieldmemo_final.pdf).

Therefore, the exempt modification request is incomplete at this time. The Council recommends that Verizon provide an RF Analysis including a rigorous cumulative far-field analysis for all entities located on the tower that accounts for a 6-foot tall person and the actual antenna pattern for the proposed modifications to the facility with a cumulative %MPE at or below 100%, on or before October 17, 2024. If additional time is needed to gather the requested information, please submit a written request for an extension of time prior to October 17, 2024. **Please provide an electronic version of the requested information for the incomplete exempt modification to be rendered complete and processed. Please include the Council's exempt modification identification number referenced above with the submittal.**

This notice of incompleteness shall have the effect of tolling the Federal Communications Commission (FCC) 60-day timeframe in accordance with Paragraph 217 of the FCC Wireless Infrastructure Report and Order issued on October 21, 2014 (FCC 14-153).

Thank you for your attention to this matter. Should you have any questions, please feel free to contact me at 860-827-2951.

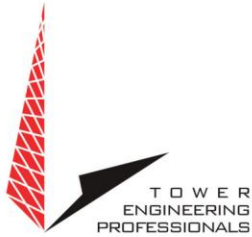
Sincerely,

A handwritten signature in dark ink, appearing to read "Melanie Bachman". The signature is fluid and cursive, with the first name "Melanie" being more prominent than the last name "Bachman".

Melanie Bachman
Executive Director

EXHIBIT 2

Revised Radio Frequency/Power Density Analysis



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Non-Ionizing Electromagnetic Radiation (NIER) Study

Site Number:

376046

Site Name:

Mansfield Center 1 CT

Location:

Storrs Mansfield, Connecticut

Tenants:

AT&T Mobility, T-Mobile, Dish Wireless
& Verizon Wireless

Prepared For:

American Tower, Inc.
Woburn, Massachusetts

August 22nd, 2024

149448 P435876

Prepared By:

Adam Carlson MS, CBRE, CPI
Engineering Associate RF Design & Service
Tower Engineering Professionals

Approved By:



10/16/24



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Contents

| | |
|--|----|
| DISCLAIMER NOTICE | 3 |
| INTRODUCTION | 4 |
| SITE AND FACILITY CONSIDERATIONS..... | 4 |
| POWER DENSITY CALCULATIONS..... | 4 |
| SITE MITIGATION & CONTROL | 5 |
| COMPLIANCE DETERMINATION..... | 5 |
| APPENDIX 1 SITE PHOTOS | 6 |
| APPENDIX 2.1 ANTENNA INVENTORY | 7 |
| APPENDIX 2.2 ANTENNA INVENTORY | 8 |
| APPENDIX 3.1 MPE LIMIT STUDY | 9 |
| APPENDIX 3.2 MPE LIMIT STUDY GENERAL POPULATION..... | 10 |
| APPENDIX 3.3 MPE LIMIT STUDY OCCUPATIONAL LIMITS..... | 11 |
| APPENDIX 4 RF HAZARD SIGNS | 12 |
| APPENDIX 5 INFORMATION PERTAINING TO MPE STUDIES | 13 |
| APPENDIX 6 MPE STANDARDS METHODOLOGY | 15 |



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Disclaimer Notice

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TOWER ENGINEERING PROFESSIONALS

RALEIGH, NORTH CAROLINA



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Non-Ionizing Electromagnetic Radiation (NIER) Study

376046 Mansfield Center 1 CT
Storrs Mansfield, Connecticut

INTRODUCTION

Tower Engineering Professionals RF Design & Services Division (TEP-RF) of Raleigh, North Carolina, has been retained by American Tower, Inc. (ATC), of Woburn, Massachusetts to evaluate the RF emissions compared to the Maximum Permissible Exposure (MPE) limit for facilities at this location. This evaluation uses compliance standards as outlined in Federal Communications Commission (FCC) document OET-65.

SITE AND FACILITY CONSIDERATIONS

Site 376046 Mansfield Center 1 CT is located at 230 Clover Mill Rd. in Storrs Mansfield, Connecticut at coordinates 41.775778, -72.222500. The support structure is 179' monopole. An aerial view of the tower can be found in Appendix 1, Site Photos. The tenants are AT&T Mobility (AT&T), T-Mobile (TMO), Dish Wireless (Dish) & Verizon Wireless (VZW). A table listing all antennae and effective radiated power (ERP) levels that were used in this study may be found in Appendix 2, Antenna Inventory.

POWER DENSITY CALCULATIONS

Power densities were calculated based on FCC MPE limits for both General Population/Uncontrolled and Occupational/Controlled environments.

For the purpose of this study, a radius of 100' from the base of the tower with a height of 6' above ground level was used, beyond 100' the MPE levels become *di minimus*. This study utilized FCC recognized and accepted software programs using the maximum ERP levels for the antenna models provided by ATC. Diagrams depicting the predicted spatial average power density level at any specific location may be found in Appendix 3, MPE Limit Study. Diagrams. Descriptions of RF signage can be found in Appendix 4, RF Hazard Signs. A discussion regarding the FCC limits may be found in Appendix 5, Information Pertaining to MPE Studies. Prediction Models used in this study may be found in Appendix 6, MPE Standards Methodology



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All data used in this study was collected from one or more of the following sources:

- ATC furnished data and does not include other unidentified communication facilities.
- Load List at 376046 Mansfield Center 1 CT. RF NIER Study 07/31/2024.
- FCC databases.
- Carrier standard configurations.
- Empirical data collected by TEP.

SITE MITIGATION & CONTROL

In order to comply with FCC, tenant, & ATC requirements, TEP recommends the placement of signage at the following points:

Site Entrance

1. Site ID Sign (tower owner defined)
2. RF Information Sign (Green)

Tower Access Point

1. RF Exposure Sign (Red)

Alpha Sector

No additional mitigation is required.

Beta Sector

No additional mitigation is required.

Gamma Sector

No additional mitigation is required

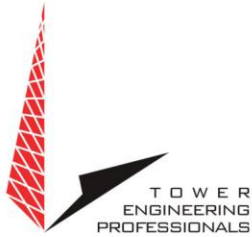
COMPLIANCE DETERMINATION

With the above mitigation implemented, this installation **WILL BE** in compliance with current FCC MPE limits as described in FCC OET-65.

Appendix 1 Site Photos



Aerial View of the Site



Appendix 2.1 Antenna Inventory

| 376046 Mansfield Center 1 CT | | | | | | | |
|------------------------------|---------|----------------------|--------------------------|----------------------|-------------|------------------------------|-----------------------|
| Antenna Inventory | | | | | | | |
| Antenna # | Carrier | Antenna Manufacturer | Antenna Model | Frequency Band (MHz) | Azimuth (°) | Effective Radiated Power (W) | Radiation Center (ft) |
| 1 | VZW | Commscope | HBXX-6517DS-A2M | 1900/2100 | 000 | 35489 | 178.0 |
| 2 | VZW | Commscope | HBXX-6517DS-A2M | 1900/2100 | 120 | 35489 | 178.0 |
| 3 | VZW | Commscope | HBXX-6517DS-A2M | 1900/2100 | 240 | 35489 | 178.0 |
| 4 | VZW | Commscope | HBXX-6517DS-A2M | 1900/2100 | 000 | 35489 | 178.0 |
| 5 | VZW | Commscope | HBXX-6517DS-A2M | 1900/2100 | 120 | 35489 | 178.0 |
| 6 | VZW | Commscope | HBXX-6517DS-A2M | 1900/2100 | 240 | 35489 | 178.0 |
| 7 | VZW | Commscope | LNx-6514DS-A1M | 700 | 000 | 9270 | 178.0 |
| 8 | VZW | Commscope | LNx-6514DS-A1M | 700 | 120 | 9270 | 178.0 |
| 9 | VZW | Commscope | LNx-6514DS-A1M | 700 | 240 | 9270 | 178.0 |
| 10 | VZW | Commscope | LNx-8513DS-VTM (39.2 lb) | 800 | 000 | 16523 | 178.0 |
| 11 | VZW | Commscope | LNx-8513DS-VTM (39.2 lb) | 800 | 120 | 16523 | 178.0 |
| 12 | VZW | Commscope | LNx-8513DS-VTM (39.2 lb) | 800 | 240 | 16523 | 178.0 |
| 13 | VZW | Samsung | MT6413-77A | 3700 | 010 | 95295 | 178.0 |
| 14 | VZW | Samsung | MT6413-77A | 3700 | 120 | 95295 | 178.0 |
| 15 | VZW | Samsung | MT6413-77A | 3700 | 250 | 95295 | 178.0 |
| 16 | VZW | Commscope | LNx-8513DS-VTM (39.2 lb) | 800 | 000 | 16523 | 178.0 |
| 17 | VZW | Commscope | LNx-8513DS-VTM (39.2 lb) | 800 | 120 | 16523 | 178.0 |
| 18 | VZW | Commscope | LNx-8513DS-VTM (39.2 lb) | 800 | 240 | 16523 | 178.0 |
| 19 | VZW | Commscope | NHH-65B-R2B | 700/800/1900 | 010 | 36735 | 178.0 |
| 20 | VZW | Commscope | NHH-65B-R2B | 700/800/1900 | 120 | 36735 | 178.0 |
| 21 | VZW | Commscope | NHH-65B-R2B | 700/800/1900 | 250 | 36735 | 178.0 |
| 22 | VZW | Commscope | NHH-65B-R2B | 700/800/1900 | 010 | 36735 | 178.0 |
| 23 | VZW | Commscope | NHH-65B-R2B | 700/800/1900 | 120 | 36735 | 178.0 |
| 24 | VZW | Commscope | NHH-65B-R2B | 700/800/1900 | 250 | 36735 | 178.0 |

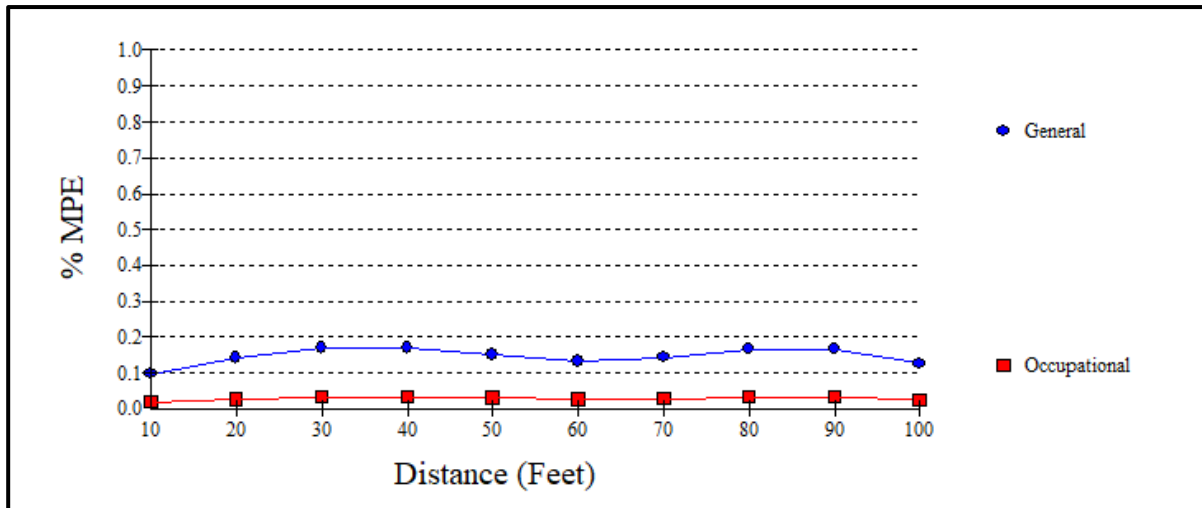


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Appendix 2.2 Antenna Inventory

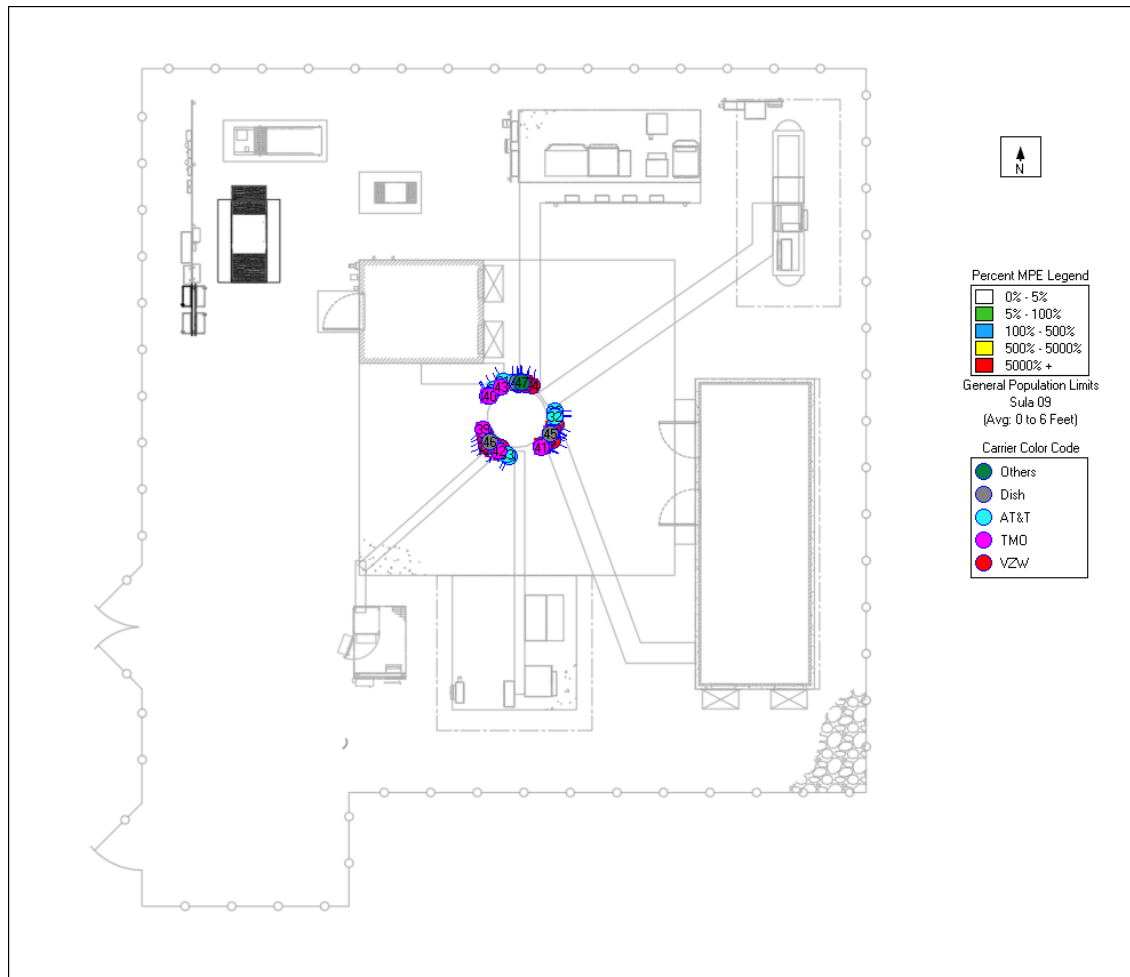
| 376046 Mansfield Center 1 CT | | | | | | | |
|------------------------------|---------|----------------------|----------------------|----------------------|-------------|------------------------------|-----------------------|
| Antenna Inventory | | | | | | | |
| Antenna # | Carrier | Antenna Manufacturer | Antenna Model | Frequency Band (MHz) | Azimuth (°) | Effective Radiated Power (W) | Radiation Center (ft) |
| 25 | AT&T | Powerwave Algon | 7770 | 1900 | 090 | 6066 | 168.0 |
| 26 | AT&T | Powerwave Algon | 7770.00 | 1900 | 210 | 6066 | 168.0 |
| 27 | AT&T | Powerwave Algon | 7770.00 | 1900 | 330 | 6066 | 168.0 |
| 28 | AT&T | Commscope | NNH4-65B-R6 | 700/800 | 090 | 10819 | 168.0 |
| 29 | AT&T | Commscope | NNH4-65B-R6 | 700/800 | 210 | 10819 | 168.0 |
| 30 | AT&T | Commscope | NNH4-65B-R6 | 700/800 | 330 | 10819 | 168.0 |
| 31 | AT&T | CCI | DMP65R-BU6DA | 700/1900 | 090 | 18423 | 168.0 |
| 32 | AT&T | CCI | DMP65R-BU6DA | 700/1900 | 210 | 18423 | 168.0 |
| 33 | AT&T | CCI | DMP65R-BU6DA | 700/1900 | 330 | 18423 | 168.0 |
| 34 | TMO | Commscope | VV-65B-R1B | 1900/2100 | 110 | 37162 | 148.0 |
| 35 | TMO | Commscope | VV-65B-R1B | 1900/2100 | 230 | 37162 | 148.0 |
| 36 | TMO | Commscope | VV-65B-R1B | 1900/2100 | 330 | 37162 | 148.0 |
| 37 | TMO | RFS | APXVAARR24_43-U-NA20 | 600/700 | 110 | 11599 | 148.0 |
| 38 | TMO | RFS | APXVAARR24_43-U-NA20 | 600/700 | 230 | 11599 | 148.0 |
| 39 | TMO | RFS | APXVAARR24_43-U-NA20 | 600/700 | 330 | 11599 | 148.0 |
| 40 | TMO | Ericsson | AIR 6419 B41 | 3700 | 110 | 69207 | 148.0 |
| 41 | TMO | Ericsson | AIR 6419 B41 | 3700 | 230 | 69207 | 148.0 |
| 42 | TMO | Ericsson | AIR 6419 B41 | 3700 | 330 | 69207 | 148.0 |
| 43 | Dish | JMA Wireless | MX08FRO665-21 | 600/1900/2100 | 000 | 27308 | 137.0 |
| 44 | Dish | JMA Wireless | MX08FRO665-21 | 600/1900/2100 | 120 | 27308 | 137.0 |
| 45 | Dish | JMA Wireless | MX08FRO665-21 | 600/1900/2100 | 240 | 27308 | 137.0 |

Appendix 3.1 MPE Limit Study (cumulative)

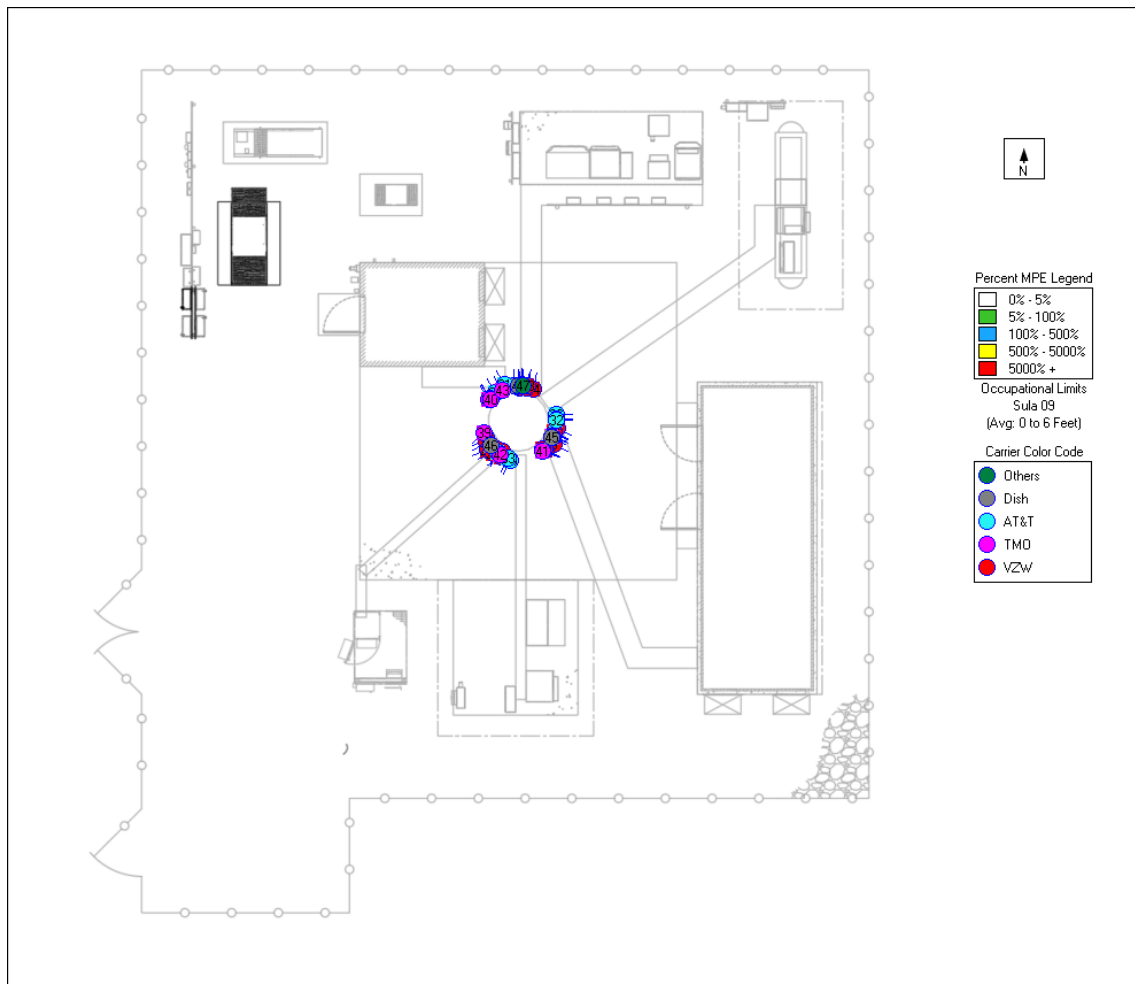


| | |
|--------------------------------|---------------------------|
| Maximum Power Density (@40'): | 0.0011 mW/cm ² |
| General Population MPE (@40'): | 0.1708% |
| Occupational MPE (@40'): | 0.0342% |





Appendix 3.2 MPE Limit Study General Population



Appendix 3.3 MPE Limit Study Occupational Limits



Appendix 4 RF Hazard Signs

| RF Safety Exposure Categorization | | | | | | | | |
|--|---------------------|---------------------|----------------|---|----------------|--------|--|---|
| Exposure Conditions | Control Measures | Signage | | | | | | |
| <ul style="list-style-type: none"> Operational of the source(s) or locations where RF fields are too weak to cause exposures greater than General Public limit. <table border="1"> <tr> <th>Cat.</th><th>Occupational Worker</th><th>General Public</th></tr> <tr> <td>1</td><td><20%</td><td><100%</td></tr> </table> <ul style="list-style-type: none"> Green zone is where the time and spatial-average is below 20% of Occupational Worker limit or <100% of General Public limit. | Cat. | Occupational Worker | General Public | 1 | <20% | <100% | <ul style="list-style-type: none"> RF Safety Guideline/NIER report must be submitted to RFSO for approval. No special EME safety practices required in these areas. No signage required except Information sign. |  <p>*the antenna owner information and Antenna Structure Registration Number and must be displayed on the sign.</p> <p>INFORMATION sign for access to rooftop/access door.</p> |
| Cat. | Occupational Worker | General Public | | | | | | |
| 1 | <20% | <100% | | | | | | |
| <ul style="list-style-type: none"> Operational of the source(s) or locations where RF exposure could cause exposure greater than General Public limit but not the Occupational Worker limit to be exceeded in accessible areas. <table border="1"> <tr> <th>Cat.</th><th>Occupational Worker</th><th>General</th></tr> <tr> <td>2</td><td>≥20% but <100%</td><td>>100%</td></tr> </table> <ul style="list-style-type: none"> Blue zone is where the spatial average is between 20%-100% of Occupational Worker limit. This limit MUST be less than the Occupational limit. | Cat. | Occupational Worker | General | 2 | ≥20% but <100% | >100% | <ul style="list-style-type: none"> RF Safety Guideline/NIER report must be submitted to RFSO for approval. Recommended RF safety awareness training for all workers in this area. Controlled areas with barriers and/or signage required in these areas. Do not walk in front of the antenna face or no loitering in this controlled area. Individual MUST have full control over any area where the exposure levels exceed the limit. |  <p>NOTICE signage shall be posted on the barriers/stanchion to prevent anyone from entering into the area (must be cordon off around the antennas - 4 posts /3 signs).</p> <p>Or must be posted in location that can be easily viewed by individuals that enter the areas of concerns.</p> |
| Cat. | Occupational Worker | General | | | | | | |
| 2 | ≥20% but <100% | >100% | | | | | | |
| <ul style="list-style-type: none"> Operational of the source(s) or locations where RF exposure exceeded the Occupational Worker limit in accessible areas. <table border="1"> <tr> <th>Cat.</th><th>Occupational Worker</th><th>General Public</th></tr> <tr> <td>3</td><td>≥100%</td><td>≥500%</td></tr> </table> <ul style="list-style-type: none"> Yellow zone is where the spatial average is above 100% of Occupational Worker limit. | Cat. | Occupational Worker | General Public | 3 | ≥100% | ≥500% | <ul style="list-style-type: none"> RF Safety Guideline/NIER report must be submitted to RFSO for approval. Individual shall not enter and work in these areas without RS approval Required RF safety training and access area is restricted only for authorized worker. Controlled areas with barriers and signage required in these areas. Do not walk in front of the antenna face. Require reduction of RF power and approval from Radiation Safety prior any work on the antennas. |  <p>CAUTION signage shall be posted on the barriers/stanchion to prevent anyone from entering into the area (must be cordon off around the antennas - 4 posts /3 signs).</p> |
| Cat. | Occupational Worker | General Public | | | | | | |
| 3 | ≥100% | ≥500% | | | | | | |
| <ul style="list-style-type: none"> Exposure will exceed exposure limit in accessible areas. <table border="1"> <tr> <th>Cat.</th><th>Occupational Worker</th><th>General Public</th></tr> <tr> <td>4</td><td>>500%</td><td>>1000%</td></tr> </table> <ul style="list-style-type: none"> Red zone is where the time and spatial-averaged levels fall above 500% of Occupational Worker limit or is not feasible to prevent exposures. | Cat. | Occupational Worker | General Public | 4 | >500% | >1000% | <ul style="list-style-type: none"> RF Safety Guideline/NIER report must be submitted to RFSO for approval. MUST re-engineer site to reduce the EME fields. No access allowed-Prohibited access! There must be controls to detect any unauthorized enter and terminate the RF energy in the area. Lock out tag out of transmitters during the maintenance of the antenna system. PPE is not sufficient. Special RF training and PPE are required. (Applies only to individuals trained by RS). |  <p>RF WARNING & Pacemaker DANGER signage or appropriate DANGER sign shall be posted very near radiation RF sources or if appropriate DANGER sign.</p> |
| Cat. | Occupational Worker | General Public | | | | | | |
| 4 | >500% | >1000% | | | | | | |



Appendix 5 Information Pertaining to MPE Studies

In 1985, the FCC first adopted guidelines to be used for evaluating human exposure to RF emissions. The FCC revised and updated these guidelines on August 1, 1996, as a result of a rule-making proceeding initiated in 1993. The new guidelines incorporate limits for Maximum Permissible Exposure (MPE) in terms of electric and magnetic field strength and power density for transmitters operating at frequencies between 300 kHz and 100 GHz.

The FCC's MPE limits are based on exposure limits recommended by the National Council on Radiation Protection and Measurements (NCRP), and, over a wide range of frequencies, the exposure limits were developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI) to replace the 1982 ANSI guidelines. Limits for localized absorption are based on recommendations of both ANSI/IEEE and NCRP.

The FCC's limits, and the NCRP and ANSI/IEEE limits on which they are based, are derived from exposure criteria quantified in terms of specific absorption rate (SAR). The basis for these limits is a whole-body averaged SAR threshold level of 4 watts per kilogram (4 W/kg), as averaged over the entire mass of the body, above which expert organizations have determined that potentially hazardous exposures may occur. The MPE limits are derived by incorporating safety factors that lead, in some cases, to limits that are more conservative than the limits originally adopted by the FCC in 1985. Where more conservative limits exist, they do not arise from a fundamental change in the RF safety criteria for whole-body averaged SAR, but from a precautionary desire to protect subgroups of the general population who, potentially, may be more at risk.

The FCC exposure limits are also based on data showing that the human body absorbs RF energy at some frequencies more efficiently than at others. The most restrictive limits occur in the frequency range of 30-300 MHz where whole-body absorption of RF energy by human beings is most efficient. At other frequencies, whole-body absorption is less efficient, and consequently, the MPE limits are less restrictive.



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MPE limits are defined in terms of power density (units of milliwatts per centimeter squared: mW/cm^2), electric field strength (units of volts per meter: V/m) and magnetic field strength (units of amperes per meter: A/m). The far-field of a transmitting antenna is where the electric field vector (E), the magnetic field vector (H), and the direction of propagation can be considered to be all mutually orthogonal ("plane-wave" conditions).

Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

General population/uncontrolled exposure limits apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general public would always be considered under this category when exposure is not employment-related, for example, in the case of a telecommunications tower that exposes persons in a nearby residential area. Additional details can be found in FCC OET 65.



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Appendix 6 MPE Standards Methodology

This study predicts RF field strength and power density levels that emanate from communications system antennae. It considers all transmitter power levels (less filter and line losses) delivered to each active transmitting antenna at the communications site. Calculations are performed to determine power density and MPE levels for each antenna as well as composite levels from all antennas. The calculated levels are based on where a human (Observer) would be standing at various locations at the site. The point of interest where the MPE level is predicted is based on the height of the Observer.

Compliance with the FCC limits on RF emissions are determined by spatially averaging a person's exposure over the projected area of an adult human body, that is approximately six-feet or two-meters, as defined in the ANSI/IEEE C95.1 standard. The MPE limits are specified as time-averaged exposure limits. This means that exposure is averaged over an identifiable time interval. It is 30 minutes for the general population/uncontrolled RF environment and 6 minutes for the occupational/controlled RF environment. However, in the case of the general public, time averaging should not be applied because the general public is typically not aware of RF exposure, and they do not have control of their exposure time. Therefore, it should be assumed that any RF exposure to the general public will be continuous.



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The FCC's limits for exposure at different frequencies are shown in the following Tables.

| 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 |

f = frequency

* = Plane-wave equivalent power density



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.

| 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

* = Plane-wave equivalent power density

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.

It is important to understand that these limits apply cumulatively to all sources of RF emissions affecting a given area. For example, if several different communications system antennas occupy a shared facility such as a tower or rooftop, then the total exposure from all systems at the facility must be within compliance of the FCC guidelines.



The field strength emanating from an antenna can be estimated based on the characteristics of an antenna radiating in free space. There are basically two field areas associated with a radiating antenna. When close to the antenna, the region is known as the Near Field. Within this region, the characteristics of the RF fields are very complex, and the wave front is extremely curved. As you move further from the antenna, the wave front has less curvature and becomes planar. The wave front still has a curvature, but it appears to occupy a flat plane in space (plane-wave radiation). This region is known as the Far Field.

Two models are utilized to predict Near and Far field power densities. They are based on the formulae in FCC OET 65.

Cylindrical Model (Near Field Predictions)

Spatially averaged plane-wave equivalent power densities parallel to the antenna may be estimated by dividing the antenna input power by the surface area of an imaginary cylinder surrounding the length of the radiating antenna. While the actual power density will vary along the height of the antenna, the average value along its length will closely follow the relation given by the following equation:

$$S = P \div 2\pi RL$$

Where:

S = Power Density

P = Total Power into antenna

R = Distance from the antenna

L = Antenna aperture length



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For directional-type antennas, power densities can be estimated by dividing the input power by that portion of a cylindrical surface area corresponding to the angular beam width of the antenna. For example, for the case of a 120-degree azimuthal beam width, the surface area should correspond to 1/3 that of a full cylinder. This would increase the power density near the antenna by a factor of three over that for a purely omni-directional antenna. Mathematically, this can be represented by the following formula:

$$S = (180 / \theta_{BW}) P \div \pi RL$$

Where:

S = Power Density

θ_{BW} = Beam width of antenna in degrees (3 dB half-power point)

P = Total Power into antenna

R = Distance from the antenna

L = Antenna aperture length

If the antenna is a 360-degree omni-directional antenna, this formula would be equivalent to the previous formula.



Spherical Model (Far Field Predictions)

Spatially averaged plane-wave power densities in the Far Field of an antenna may be estimated by considering the additional factors of antenna gain and reflective waves that would contribute to exposure.

The radiation pattern of an antenna has developed in the Far Field region and the power gain needs to be considered in exposure predictions. Also, if the vertical radiation pattern of the antenna is considered, the exposure predictions would most likely be reduced significantly at ground level, resulting in a more realistic estimate of the actual exposure levels.

Additionally, to model a truly "worst case" prediction of exposure levels at or near a surface, such as at ground-level or on a rooftop, reflection off the surface of antenna radiation power can be assumed, resulting in a potential four-fold increase in power density.

These additional factors are considered, and the Far Field prediction model is determined by the following equation:

$$S = EIRP \times Rc \div 4\pi R^2$$

Where:

S = Power Density

EIRP = Effective Radiated Power from antenna

Rc = Reflection Coefficient (2.56)

R = Distance from the antenna

The EIRP includes the antenna gain. If the antenna pattern is considered, the antenna gain is relative based on the horizontal and vertical pattern gain values at that particular location in space, on a rooftop or on the ground. However, it is recommended that the antenna radiation pattern characteristics not be considered to provide a conservative "worst case" prediction. This is the equation is utilized for the Far Field exposure predictions herein.