

**NON-IONIZING ELECTROMAGNETIC EXPOSURE ANALYSIS
&
ENGINEERING CERTIFICATION**



SITE NUMBER: SE02629A

SITE NAME: Mercer Island WT

**SITE ADDRESS: 4350 88th Ave SE
Mercer Island, WA 98040**

DATE: September 24, 2018

PREPARED BY:

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PROJECT

The proposed T-Mobile project consists of a WCF (Wireless Communications Facility) with BTS equipment located at 4350 88th Ave SE, Mercer Island, WA 98040, King County parcel number 4457300325. The planned improvements include (3) additional panel antennas on a 100' steel self-support tower with supporting BTS (Base Transmission System) radio equipment located in at the base of the tower.

EQUIPMENT

Type of Service: Broadband PCS, UMTS, LTE

Antennas: Commscope SBNHH-1D65C

Sectors: 3 (alpha = 45°, beta = 180°, gamma = 330°)

Antenna Rad Center: 81'- 9" AGL

CALCULATIONS

Calculations for RF power densities near ground level are based on the "**Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields OET Bulletin 65**" Edition 97-01, August 1997 issued by the Federal Communications Commission Office of Engineering & Technology.

Section 2 of **OET Bulletin 65** demonstrates that "for a truly worst-case prediction of power density at or near the surface, such as at ground-level or on a rooftop, 100% reflection of incoming radiation can be assumed, resulting in a potential doubling of predicted field strength and a four-fold increase in (far field equivalent) power density". Therefore, the following equation is used:

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

Where S = power density (mW/cm²), EIRP = equivalent isotropically radiated power and R = distance to the center of the radiation antenna (cm)

Attached as an exhibit are the MPE (Maximum Permissible Exposure) calculations using the above referenced formula and the antenna manufacturer vertical pattern information using a conservative 20 dB loss below main lobe.

The calculations show that the maximum MPE at ground level (6' above AGL) at the base of the tower and the power density is 0.001964 mW/cm² with an assumed worst-case power level of 2,000 watts ERP. This is 0.4205% of the MPE limit for the general population/uncontrolled exposure of 0.467 mW/cm² as referenced in **Table I OET Bulletin 65 Appendix A** for the lowest frequency range.

OTHER CARRIERS

The following are examples of wireless carriers providing service in King County:

| | | |
|----------|-------------|------------------------|
| ESMR | 851-866 Mhz | Nextel |
| Cellular | 869-894 Mhz | AT&T, Verizon |
| PCS | > 1800 Mhz | Sprint, T-Mobile, AT&T |

Wireless facility antennas are highly directional and project the majority of the RF energy horizontally. Attached as an exhibit are the MPE (Maximum Permissible Exposure) calculations using the referenced power density formula. These calculations assume that the vertical patterns of the antennas suppress the ERP by 20 dB towards the antenna base. The calculations show that the maximum total MPE at ground level (6' above AGL) at the base of the tower is 0.002285 mW/cm² with the carrier operating at a total ERP of 3,000 watts per sector. This is 0.4894% of the MPE limit for the general population/uncontrolled exposure of 0.467 mW/cm² for the lowest frequency (700/1500) as referenced in **Table I OET Bulletin 65 Appendix A**.

COLOCATED FACILITIES TOTAL MPE

The combined MPE for the T-Mobile Wireless antennas and the existing carriers using "worst case" calculations is: 0.001964 mW/cm² + 0.002285 mW/cm² = 0.004249 mW/cm² Total MPE.

ENVIRONMENTAL EVALUATION

Routine environmental evaluation is required if the PCS broadband facility is less than 10 m (32.81 feet) AGL and has a total power of all channels in any given sector greater than 2,000W ERP as referenced in "**Table 2 Transmitters**,

Facilities and Operations subject to Routine environmental Evaluation” of Bulletin 65. As the proposed antennas lowest point above ground level is 23.7 m (77.75 feet), the WCF is categorically exempt from requirement for routine environmental processing.

FCC COMPLIANCE

The general population/uncontrolled exposure near the tower, including persons at ground level, surrounding properties, inside and utility pole on existing structures will have RF exposure much lower than the “worst case” scenario, which is a small fraction of the MPE limit.

Only trained persons will be allowed to climb the tower for maintenance operations. T-Mobile and/or its contractors will provide training to make the employees fully aware of the potential for RF exposure occupational training and they can exercise control over their exposure that is within the occupational/controlled limits.

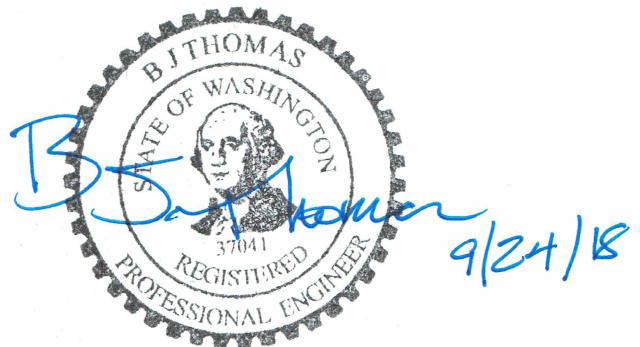
CONCLUSIONS

Based on calculations, the proposed WCF will comply with current FCC and county guidelines for human exposure to radiofrequency electromagnetic fields.

All representations contained herein are true to the best of my knowledge.

EXHIBITS

- MPE Calculations
- Antenna Product Data Sheets
- WCF Location Map



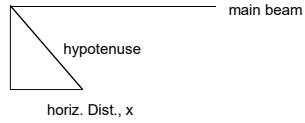
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MPE Calculations**

Effective tower height assumes a person 6 ft tall.

81.75 height (ft)

| | |
|----------|---|
| 1.96E-03 | |
| 0.001964 | max power density in mW/cm ² |
| 0.4205% | percentage of standard |

tower height, y



Note: 0.467 mW/cm² is 100% of allowable standard for lowest frequency

| radiation center (feet), y | effective tower height (feet), y | minor lobe angle | dB below main lobe | horiz. dist. x | hypotenuse length (feet) | hypotenuse length (km) | hypotenuse length (cm) | ERP main lobe (watts) | ERP main lobe (dBm) | minor lobe ERP (dBm) | minor lobe EIRP (dBm) | minor lobe EIRP (mW) | Power at point x at ground level mW/cm ² |
|----------------------------|----------------------------------|------------------|--------------------|----------------|--------------------------|------------------------|------------------------|-----------------------|---------------------|----------------------|-----------------------|----------------------|---|
| 81.75 | 75.75 | 90 | 20 | 0.000 | 75.750 | 0.023 | 2308.860 | 2000 | 63.01 | 43.01 | 45.17 | 32887.43 | 1.96E-03 |
| TOTAL | | | | | | | | | | | | 1.96E-03 | |

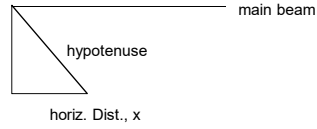
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Other Carriers
MPE Calculations**

Effective tower height assumes a person 6 ft tall.

92 height (ft)

| | |
|----------|---|
| 2.29E-03 | |
| 0.002285 | max power density in mW/cm ² |
| 0.4894% | percentage of standard |

tower height, y



Note: 0.467 mW/cm² is 100% of allowable standard for lowest frequency

| radiation center (feet), y | effective tower height (feet), y | minor lobe angle | dB below main lobe | horiz. dist. x | hypotenuse length (feet) | hypotenuse length (km) | hypotenuse length (cm) | ERP main lobe (watts) | ERP main lobe (dBm) | minor lobe ERP (dBm) | minor lobe EIRP (dBm) | minor lobe EIRP (mW) | Power at point x at ground level mW/cm ² |
|----------------------------|----------------------------------|------------------|--------------------|----------------|--------------------------|------------------------|------------------------|-----------------------|---------------------|----------------------|-----------------------|----------------------|---|
| 92 | 86 | 90 | 20 | 0.000 | 86.000 | 0.026 | 2621.280 | 3000 | 64.77 | 44.77 | 46.93 | 49331.15 | 2.29E-03 |
| TOTAL | | | | | | | | | | | | 2.29E-03 | |

CommScope—Proprietary and Confidential. Preliminary specifications are for illustrative purposes only and will be updated prior to publication.

FFHH-65C-R3

8-port sector antenna, 4x 617-806 and 4x 1695-2360 MHz, 65° HPBW, 3x RET, 600 MHz-Ready Antenna Technology

Electrical Specifications

| Frequency Band, MHz | 617-698 | 698-806 | 1695-1880 | 1850-1990 | 1920-2200 | 2300-2360 |
|--------------------------------------|------------|------------|------------|------------|------------|------------|
| Gain, dBi | 15.6 | 16.2 | 18.1 | 18.4 | 18.6 | 19.0 |
| Beamwidth, Horizontal, degrees | 67 | 64 | 58 | 61 | 63 | 63 |
| Beamwidth, Vertical, degrees | 10.6 | 9.3 | 5.6 | 5.2 | 4.9 | 4.4 |
| Beam Tilt, degrees | 2-13 | 2-13 | 2-12 | 2-12 | 2-12 | 2-12 |
| USLS (First Lobe), dB | 17 | 17 | 19 | 18 | 19 | 20 |
| Front-to-Back Ratio at 180°, dB | 27 | 27 | 35 | 35 | 35 | 32 |
| Isolation, dB | 28 | 28 | 28 | 28 | 28 | 28 |
| Isolation, Intersystem, dB | 28 | 28 | 28 | 28 | 28 | 28 |
| VSWR Return Loss, dB | 1.5 14.0 | 1.5 14.0 | 1.5 14.0 | 1.5 14.0 | 1.5 14.0 | 1.5 14.0 |
| PIM, 3rd Order, 2 x 20 W, dBc | | -153 | -153 | -153 | -153 | -153 |
| Input Power per Port, maximum, watts | 250 | 250 | 300 | 300 | 300 | 300 |
| Polarization | ±45° | ±45° | ±45° | ±45° | ±45° | ±45° |
| Impedance | 50 ohm | 50 ohm | 50 ohm | 50 ohm | 50 ohm | 50 ohm |

General Specifications

| | |
|----------------------------|---------------------------------|
| Operating Frequency Band | 1695 - 2360 MHz 617 - 806 MHz |
| Antenna Type | Sector |
| Band | Multiband |
| Performance Note | Outdoor usage |
| Total Input Power, maximum | 800 W @ 50 °C |

Mechanical Specifications

| | |
|----------------------------------|--|
| RF Connector Quantity, total | 8 |
| RF Connector Quantity, low band | 4 |
| RF Connector Quantity, high band | 4 |
| RF Connector Interface | 4.3-10 Female |
| Color | Light gray |
| Grounding Type | RF connector inner conductor and body grounded to reflector and mounting bracket |
| Radiator Material | Aluminum Low loss circuit board |
| Radome Material | Fiberglass, UV resistant |
| Reflector Material | Aluminum |
| RF Connector Location | Bottom |
| Wind Loading, frontal | 1926.0 N @ 150 km/h 433.0 lbf @ 150 km/h |
| Wind Loading, lateral | 351.0 N @ 150 km/h 78.9 lbf @ 150 km/h |
| Wind Loading, rear | 1946.0 N @ 150 km/h 437.5 lbf @ 150 km/h |
| Wind Speed, maximum | 241 km/h 150 mph |

Dimensions

FFHH-65C-R3

| | |
|----------------------------------|---------------------|
| Length | 2438.0 mm 96.0 in |
| Width | 640.0 mm 25.2 in |
| Depth | 235.0 mm 9.3 in |
| Net Weight, without mounting kit | 57.0 kg 125.7 lb |

Remote Electrical Tilt (RET) Information

| | |
|---|-----------------------------------|
| Input Voltage | 10-30 Vdc |
| Internal RET | High band (2) Low band (1) |
| Power Consumption, idle state, maximum | 1.0 W |
| Power Consumption, normal conditions, maximum | 8.0 W |
| Protocol | 3GPP/AISG 2.0 (Single RET) |
| RET Interface | 8-pin DIN Female 8-pin DIN Male |
| RET Interface, quantity | 1 female 1 male |

Regulatory Compliance/Certifications

| Agency | Classification |
|----------------------------|--|
| RoHS 2011/65/EU | Compliant by Exemption |
| China RoHS SJ/T 11364-2006 | Above Maximum Concentration Value (MCV) |
| ISO 9001:2008 | Designed, manufactured and/or distributed under this quality management system |



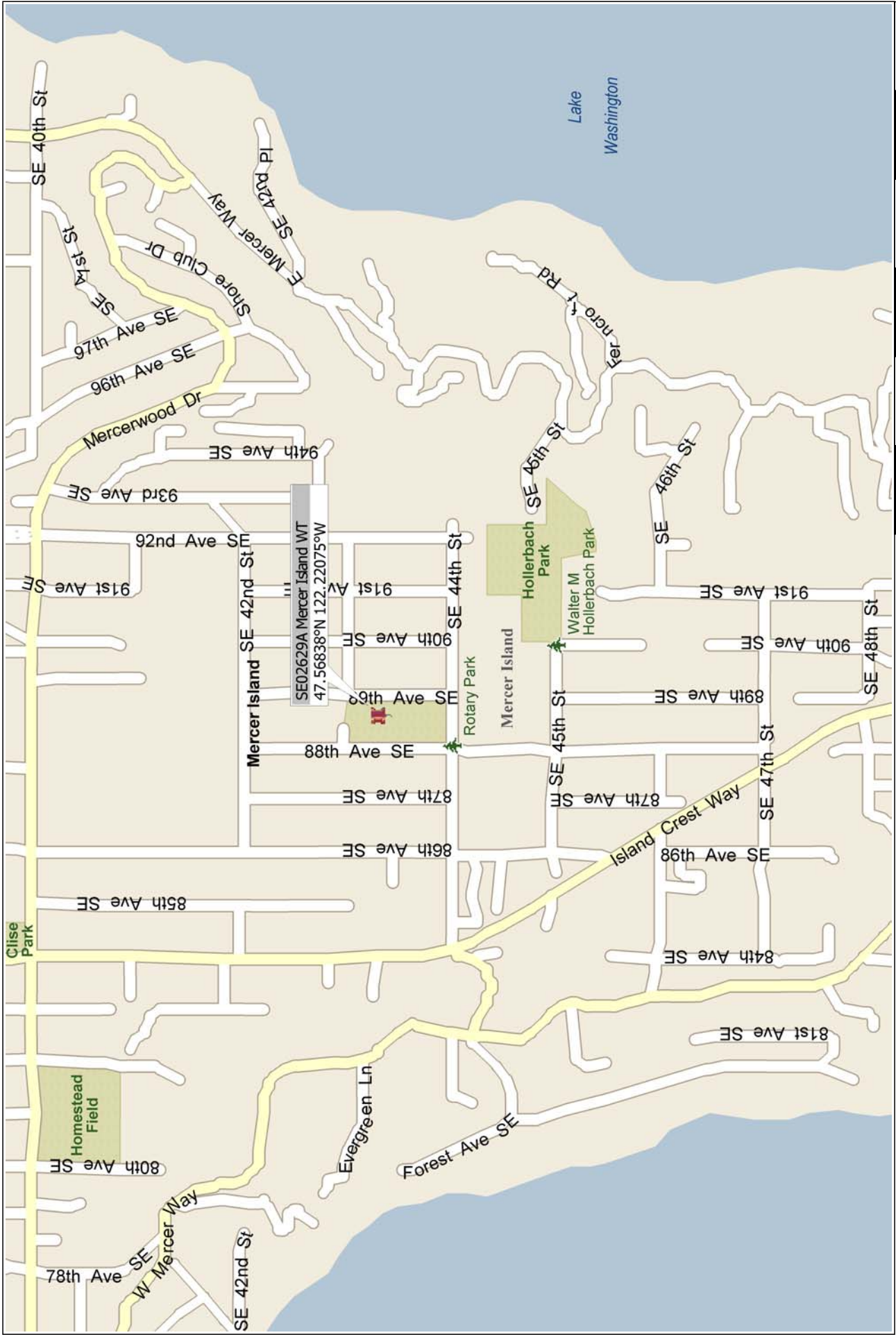
Included Products

BSAMNT-4 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

| | |
|------------------|---|
| Performance Note | Severe environmental conditions may degrade optimum performance |
|------------------|---|

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