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ENGINEERING STATEMENT:
RF EXPOSURE LEVEL STUDY

WEST TIGER MOUNTAIN
TRANSMITTER SITE
NEAR ISSAQUAH, WASHINGTON

PREPARED FOR
AMERICAN TOWER CORP.
SEPTEMBER 2020

Overview

American Tower Corporation ("ATC") is the owner of tower structures with ASR numbers 1056093 and 1056094 on West Tiger Mountain, which host a number of FM and TV broadcast transmitting facilities. Recently, the combined FM antenna (which was severely damaged by fire in November 2018) was replaced with a new ERI model SHPXA-16BC-HW-SP "rototiller" antenna.

At the request of ATC, the undersigned has performed calculations of the worst-case ground-level RF exposure levels which result from operation of the FM and TV broadcast stations at this transmitter site. These calculations are described in the following text, and demonstrate that the broadcast operations at the site are within the applicable FCC Maximum Permissible Exposure ("MPE") guidelines.

West Tiger Mountain Site and Stations

Tiger Mountain is located southeast of the city of Issaquah, Washington. The mountain has six main named summits, several of which are used as sites for communication towers. ATC is the owner of towers located at West Tiger Mountain #1, which are used by broadcast FM and TV stations serving the Seattle-Tacoma market. There are two main broadcast sites, one site at the true summit of West Tiger Mountain #1, and one site located 470 meters to the east at a slightly lower summit. It is this latter site (indicated by the yellow box on the map on the following page) which is the location of the two towers which are the subject of this study.

Tiger Mountain is cris-crossed by numerous public hiking trails and roads that are used by hikers and mountain bikers. While some access controls and warning signage are in place to limit or discourage casual access, this study demonstrates that this transmitter site is in compliance with the FCC MPE for uncontrolled areas which are accessible to the general population. Since these requirements are 20% of the FCC guidelines for controlled areas, the site is therefore in compliance with both the uncontrolled area MPE and the controlled area MPE.

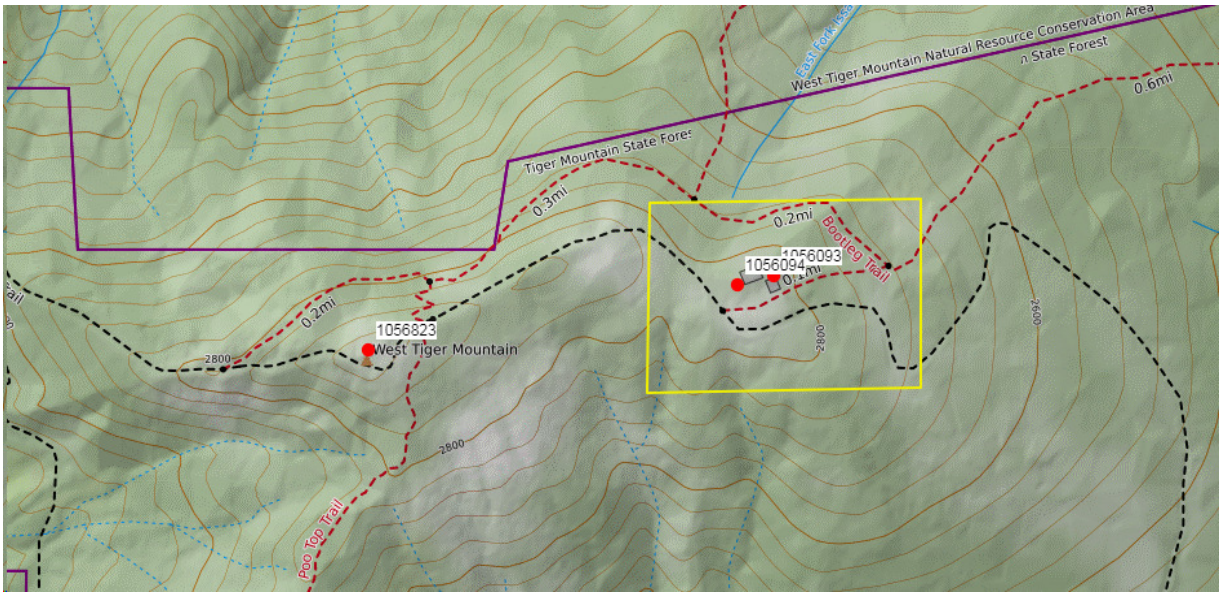

Figure 1 - Yellow box indicates site which is the subject of this study

ATC has two tower structures at this site, which host the following broadcast stations. Antenna models are taken from FCC filings except as noted.

Tower ASR 1056093 (ATC #7509)

Callsign	Frequency	ERP	Antenna Model
KQMV(FM)	92.5 MHz	60 kW H+V	ERI SHPX-16BC-HW-SP
KSWD(FM)	94.1 MHz	73 kW H+V	ERI SHPX-16BC-HW-SP
KJAQ(FM)	96.5 MHz	52 kW H+V	ERI SHPX-16BC-HW-SP
KNUC(FM)	98.9 MHz	68 kW H+V	ERI SHPX-16BC-HW-SP
KZOK-FM	102.5 MHz	73 kW H+V	ERI SHPX-16BC-HW-SP
KBKS-FM	106.1 MHz	73 kW H+V	ERI SHPX-16BC-HW-SP

Tower ASR 1056094 (ATC #7500)

Callsign	Channel	ERP	Antenna Model
KUSE-LD[1]	Ch12	3 kW H+V	Kathrein 2X3 750 000085 [2]
KIRO-DRT[3]	Ch18	3.8 kW H	ERI AL4P-18-H
KWPX-TV	Ch33	400 kW H	Dielectric TFU-31ETT-R CTSP
KWDK(TV)	Ch34	123 kW H 36.9 kW V	SWR SWEDM12OI/34-EP

RF Exposure Calculations

The power density calculations shown below were made using the techniques outlined in OET Bulletin No. 65. "Ground level" calculations in this report have been made at a reference height of 2 meters above ground to provide a worst-case estimate of exposure for persons standing on the ground in the vicinity of the tower. The equation shown below was used to calculate the ground level power density figures from each antenna.

$$S(\mu W/cm^2) = \frac{33.40981 \times AdjERP(Watts)}{D^2}$$

Where: *AdjERP(Watts)* is the maximum lobe effective radiated power times the element pattern factor times the array pattern factor.

D is the distance in meters from the center of radiation to the calculation point.

Ground level power densities have been calculated for locations extending from the base of the tower to a distance of 500 meters. Values past this point are increasingly negligible.

[1] At the time of preparation of this study, the FCC's technical database shows that KUSE-LD is still licensed on Channel 46. However since the KUSE-LD license application for operation on Channel 12 was filed on 7/17/2020 and is currently pending, it is presumed that KUSE-LD is operating on its new channel.

[2] The FCC database shows the KUSE-LD antenna model as a horizontally-polarized Dielectric TLP-J, as was listed in this station's applications for construction permit and for license. However the TLP line is a UHF antenna, while KUSE-LD operates now on VHF Channel 12. The pending KUSE-LD license application includes a brief exhibit noting the substitution of a circularly-polarized Kathrein 2X3 750 000085 panel antenna array; this exhibit may or may not be sufficient to get the model correctly indicated in the FCC database. Documentation of the installed Kathrein 2X3 750 000085 antenna was provided to the undersigned by ATC, and has been used for the calculations in this report.

[3] This KIRO facility is a Digital Replacement Translator, or "DRT".

Calculations of the ground-level power densities of the FM stations have been performed using the Commission's FMModel software, which incorporates the formula above. All six FM stations operate from the ERI model SHPXA-16BC-HW-SP "rototiller" antenna, which is classified as an "EPA Type 3" antenna for use with this software. This antenna is nominally half-wavelength-spaced at 60 inches between bay centers. However, the actual wavelength spacing between antenna elements varies by the frequency of the FM stations; this has been taken into account in the calculations.

Calculations of the ground-level power densities of the TV stations have been performed using the formula above, referencing the elevation radiation pattern which was filed with the station's licensing documents. The relative field value indicated in the table is the maximum value which occurs at 45 degrees or more below the horizontal, based on the manufacturer's elevation pattern. The resulting adjusted ERP value is assumed to be radiated straight down to a point 2 meters above ground level at the base of the tower, resulting in a worst-case calculation.

Calculations of the power density produced by the stations at this transmitter site are summarized in the table on the following page:

Callsign Channel	Avg or Peak ERP Antenna Model	Relative Field	Height AGL	Calculated Max Exposure	Gen Pop FCC MPE	% of MPE
KQMV(FM) 223C	60 kW H + V ERI SHPX-16BC-HW-SP 16-bay 0.47 wave	FMModel Type 3	63 m [4]	2.0 μW/cm²	200 μW/cm²	1.0%
KSWD(FM) 231C	73 kW H + V ERI SHPX-16BC-HW-SP 16-bay 0.48 wave	FMModel Type 3	63 m	2.4 μW/cm²	200 μW/cm²	1.2%
KJAQ(FM) 243C	52 kW H + V ERI SHPX-16BC-HW-SP 16-bay 0.49 wave	FMModel Type 3	63 m	1.6 μW/cm²	200 μW/cm²	0.8%
KNUC(FM) 255C	68 kW H + V ERI SHPX-16BC-HW-SP 16-bay 0.50 wave	FMModel Type 3	63 m	2.1 μW/cm²	200 μW/cm²	1.1%
KZOK-FM 273C	73 kW H + V ERI SHPX-16BC-HW-SP 16-bay 0.52 wave	FMModel Type 3	63 m	2.1 μW/cm²	200 μW/cm²	1.1%
KBKS-FM 291C	73 kW H + V ERI SHPX-16BC-HW-SP 16-bay 0.54 wave	FMModel Type 3	63 m	1.9 μW/cm²	200 μW/cm²	1.0%
KUSE-LD 12	3 kW H + V KAT 2X3 750 000085	0.251	69 m	2.8 μW/cm²	200 μW/cm²	1.4%
KIRO-DRT 18	3.8 kW H ERI AL4P-18-H	0.279	70 m	2.1 μW/cm²	329 μW/cm²	0.6%
KWPX-TV 33	400 kW H DIE TFU-31ETT-R-CTSP	0.040	82.9 m	3.3 μW/cm²	389 μW/cm²	0.8%
KWDK(TV) 34	123 kW H 36.9 kW V SWR SWEDM12OI/34-EP	0.100[5]	53.9 m[6]	19.8 μW/cm²	393 μW/cm²	5.0%

[4] The actual install height of the ERI SHPX-16BC-HW-SP antenna is reported by ERI to be 206.6 feet or 63 meters. The antenna heights listed on the FCC licenses of the six FM stations vary somewhat depending on whether they were part of the initial FM install on this site, or were added to the combiner system later, but the actual install value of 63 meters above ground is used for the calculations in this study as it is lower than any of the antenna heights listed on the station licenses. In all cases, this is within the installation tolerance permitted by the FCC Rules.

[5] The construction permit application for KWDK utilized a relative field value of 0.100 for RF exposure calculations. While the application did not include a copy of the antenna's elevation pattern, comparison against other 12-slot antennas (such as ERI and Dielectric) shows 0.100 relative field to be a very valid maximum value for angles more than 45 degrees below the horizontal.

[6] The FCC license for KWDK indicates an antenna radiation center of 61.3 meters (201 feet). However the installation diagrams provided to the undersigned by ATC show the actual install height as 53.9 meters (177 feet). The actual install height has been used for these calculations.

These calculations show that the maximum worst-case calculated power density produced at two meters above ground level by the operations all FM and TV broadcast stations on these two towers (were their maxima to coincide, which they do not) is 14% of the FCC MPE for uncontrolled environments.

Several other FM stations operate from a tower located on a separate knoll 470 meters to the west of the towers which are the subject of this analysis. Due to the distance separation, those stations are not believed to be meaningful contributors to exposure levels at this tower site.

Statement of Engineer

This Engineering Statement and RF Exposure Study, has been prepared by the undersigned on behalf of American Tower Corporation. All representations herein are true to the best of my knowledge. I am an experienced radio engineer whose qualifications are a matter of record with the Federal Communications Commission. I am a partner in the firm of Hatfield & Dawson Consulting Engineers and am Registered as a Professional Engineer in the States of Washington and Colorado.

Signed this 21nd day of September, 2020

Erik C. Swanson, P.E.