Pennsylvania, the station is able to share the facility at Pine Grove Mills. The site is well-situated to permit delivery of signals to the Happy Valley region in which is located the city of State College – one of the three main population centers in the WPSU service area. (The other two are Altoona and Johnstown, both PA, to better serve which the two additional DTx transmitters are planned in the future.) The Pine Grove Mills location also is positioned in the general direction of Altoona and Johnstown, from the perspective of State College, allowing better service to receivers having antennas aimed toward the transmitters of the commercial stations in those communities, which are the other principal population centers for which the market where WPSU is located is named (i.e., the Johnstown-Altoona-State College Designated Market Area, as determined by Nielsen Media Research). It should be noted that WPSU provides the only Public Television service to its market.

Facilities

The facilities requested in this application include continued operation at 810 kW ERP at a height above average terrain (HAAT) of 413 meters at Site 1 in Clearfield and operation at 48 kW ERP at 283 meters HAAT at Site 2 in Pine Grove Mills. Both sites meet the requirements for maximum allowable facilities specified by §73.622(f)(8)(ii) of the Commission's Rules, as further permitted for DTS operations by the DTS R&O.[7] The basic characteristics of the transmitters proposed in the WPSU-TV DTS network are given in Figures 1a and 1b for Sites 1 and 2, respectively, at the end of this report and in the related DTS Engineering portions of the Form 340 application – one for each transmitter.

Two fundamental antenna designs are included in the WPSU-TV DTS network. The Clearfield antenna is a shallow cardioid, center-fed, slotted coaxial design with no mechanical beam tilt. It has characteristics primarily intended to maximize service throughout the historic WPSU service area and also originally was intended to provide interference protection to an analog co-channel station in an adjacent market[8] by reducing field strength in its direction. The necessary protection to the analog neighbor resulted in

[7] DTS R&O ¶41.
[8] WLYH-TV, analog Channel 15 in Lancaster, PA.

reduced signal strength in the direction of State College, thereby exacerbating there the reduction of predicted service attendant on the change by WPSU from analog Channel 3 to digital Channel 15.[9]

The antenna at Pine Grove Mills is a low-power, center-fed, slotted coaxial design. It has a peanut-shaped pattern intended to maximize the service throughout the Happy Valley region formed between two mountain ridges by glacial action. One of those ridges is where the Pine Grove Mills transmitter is situated; the other is the ridge of Rattlesnake Mountain that forms a terrain obstruction between the Clearfield transmitter and the three population centers of State College, Altoona, and Johnstown. The antenna at Pine Grove Mills is tilted mechanically to increase field strength in State College and the surrounding valley region.

A plot of the PNLCs[10] of the transmitters is provided in Figure 2. Since the main, Clearfield transmitter facility authorized by the outstanding construction permit (herein DTS Site 1) already covers the entire authorized service area of the station,[11] the provisions of §73.626(f)(1) are met by that facility alone. By virtue of the overlap of the contours of the two transmitters, they are contiguous, thereby meeting the requirements of §73.626(f)(3). Also shown in Figure 2 is the 48 dBu contour of the DTS Site 1 facility, which can be seen to encompass the principal community of Clearfield, PA. There are no major obstructions in the path over the principal community; thus, the requirements of §73.625(a) and correspondingly of §73.626(f)(4) also are met by the DTS Site 1 transmitter alone. Both transmitters in the proposed DTS network are located within the WPSU-TV authorized service area, consequently meeting the requirements of §73.626(f)(6).

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[9] As was described previously in the original application for what became the experimental license at the Pine Grove Mills site, use of any possible alternatives to improve service to the population centers on the southern tier of the WPSU service area was stymied by a combination of FAA tower location rules and the need to maintain service to the area of north-central Pennsylvania, where WPSU frequently provides the only terrestrial television service. A consequence of this situation was the decision to use an additional transmitter to improve the service within the station's historic service area.

[10] To account for the dipole correction factor, the PNLCs are plotted at 38.8 dBu, with service statistics of F(50,90).

[11] Per §73.626(b), "For purposes of compliance with this section, a station's 'authorized service area' is defined as the area within its predicted noise-limited service contour determined using the facilities authorized for the station in a license or construction permit for non-DTS, single-transmitter-location operation."

Although they were filed in the Technical Statement accompanying the construction permit modification application that this application now seeks to further modify, a description and plots of the pattern characteristics for the DTS Site 1 (Clearfield) antenna nevertheless are reproduced herein. The DTS Site 1 antenna is oriented to place the center of the omnioid azimuth pattern at 299 degrees true. Elevation power gain of the antenna is 28.50 (14.55 dBd) at the vertical beam maximum (1.15 degrees below horizontal), 14.25 (11.54 dBd) in the horizontal plane, and 23.925 (13.79 dBd) at 0.563 degree below horizontal, the average depression angle to the radio horizon (computed at 1-degree azimuth intervals). The azimuth power gain is 1.18 (0.79 dB), yielding a total power gain in the main beam of 34.20 (15.34 dBd), in the horizontal plane of 17.10 (12.33 dBd), and toward the radio horizon of 28.71 (14.58 dBd).

A plot of the azimuthal radiation pattern of the DTS Site 1 antenna in relative field values is included as Figure 3. The azimuthal power pattern expressed in decibels relative to 1 kW (dBk), at the depression angle having maximum power (1.15 degree depression), is plotted in Figure 4. The tabulated azimuthal field and power values are given in Figure 5. The elevation radiation pattern in relative field values is included as Figure 6. The elevation power pattern expressed in dBk is plotted in Figure 7. The tabulated elevation field and power values are given in Figure 8. Also uploaded to the CDBS Electronic Filing System (EFS) web site is a version of the elevation pattern in Office Open XML format, with the first column containing depression angle values and the second column containing relative field values of elevation pattern data. Only a single elevation pattern applies to the antenna, and there is no mechanical beam tilt, so only a single column of elevation data is supplied.

A description and plots of the pattern characteristics for the DTS Site 2 (Pine Grove Mills) antenna first were filed in 2001 in the Technical Statement accompanying the original Form 346 booster application that eventually was converted by the Commission into an experimental license for the site. For ease of reference, those details are provided again herein. The DTS Site 2 antenna is oriented to place the center of symmetry of the peanut azimuth pattern at 330 degrees true. Elevation power gain of the antenna design for DTS Site 2 is 16.0 (12.04 dBd) at the vertical beam maximum (1.0 degree below

horizontal of the antenna itself, prior to application of mechanical beam tilt) and 11.3 (10.53 dBd) in the horizontal plane (again, prior to application of mechanical beam tilt). The azimuth power gain is 2.00 (3.01 dB), yielding a total power gain in the main beam of 32.00 (15.05 dBd) and of 22.6 (13.54 dBd) in the horizontal plane (without the effects of mechanical beam tilt).

A plot of the DTS Site 2 antenna azimuthal radiation pattern in relative field values is included as Figure 9. The azimuthal power pattern expressed in decibels relative to 1 kW (dBk), at the depression angle having maximum power (1 degree depression), is plotted in Figure 10. The tabulated azimuthal field and power values are given in Figure 11. The elevation radiation pattern in relative field values is included as Figure 12. The elevation power pattern expressed in decibels relative to 1 kW (dBk), in the azimuthal direction having maximum power, is plotted in Figures 13. The tabulated elevation field and power values are given in Figure 14. All of these plots and tables are based on data derived prior to application of mechanical beam tilt and therefore do not incorporate its effects, which are fully expressed in the data of the elevation patterns placed on file in the online application. The elevation pattern data for the Site 2 antenna has been uploaded to the CDBS Electronic Filing System (EFS) web site in complex array form in Office Open XML format, with the first column containing depression angle values for each row and the first row containing azimuth values for each column.

Although only a single elevation pattern applies to the antenna for DTS Site 2, mechanical beam tilt will be applied to it. Since the software that the Commission will use to process this application is not yet directly capable of evaluating mechanical beam tilt, the pattern translation implicit in mechanical beam tilt has been pre-applied to the data uploaded to the EFS. Consequently, a large array of elevation data has been supplied for the Site 2 antenna, using the complex data filing format and incorporating the effects of the mechanical beam tilt. Furthermore, it has been found with earlier filings for other stations that inclusion of azimuth pattern data or rotation information in the Form 340 DTS interferes with the correct determination of the orientation and amplitude characteristics of the pattern in the Commission's processing software. For this reason, the Site 2 Form 340 DTS has been marked that the antenna is "Non-

Directional" and that no mechanical beam tilt is applied. The antenna, however, is directional and mechanical beam tilt is applied, with the alternate settings being required to make the Commission's input processing software correctly represent the data that describes the antenna. The actual azimuth rotation and mechanical beam tilt angle and heading for the antenna at DTS Site 2 are provided in Figure 1b below.

It should be noted that, once the Commission's DTS processing software is complete and directly can handle both the azimuth rotation and mechanical beam tilt of complex patterns, then such alternate settings as those described here may not be required for later filings by other stations. Moreover, once the DTS processing software is completed, it is expected that the data supplied in this application will continue to be correctly processed, thereby making it compatible with future interference analyses conducted for other stations.

Both of the transmitters used in the WPSU-TV DTS network are Type Verified as per Section 73.1660 of the Commission's Rules. Both transmitters are of solid state designs. They are synchronized using the methods specified in the ATSC Synchronization Standard for Distributed Transmission (A/110B), and they emit the RF Watermark transmitter identification signal defined in the A/110B document.

Service Area

The DTS R&O states, in paragraph 33,

> "We recognize, and agree with commenters, that in circumstances where transmitters are placed inside but near the edge of a station's authorized service area, it may be technically difficult to ensure that signals from that transmitter will not carry beyond the station's authorized service area. For most stations, our decision to use the Table of Distances based on maximum facilities will allow them flexibility to cover their entire authorized service area with DTS service. For those situations in which a station's authorized service area extends beyond its Table of Distances coverage, we will consider, on a case-by-case basis, requests to locate a DTS transmitter inside, but near the edge of, the station's authorized service area with facilities that may result in signal transmissions beyond that area by a minimal distance. Such placement must be shown to be necessary to adequately serve the population inside of a station's authorized service area."

Figure 1b — Technical Specifications — Proposed WPSU DTS Facility Channel 15 — Clearfield, PA — Site 2: Pine Grove Mills

Frequency

Channel	15
Frequency Band	476 – 482 MHz
Center Frequency	479 MHz

Location

Site	Pine Grove Mills, PA
Geographic Coordinates (NAD27)	40° 42’ 46.77” N 77° 54’ 01.00” W
Tower Registration (FAA Study Number)	1024968 (N/A)

Elevation

Elevation of site above mean sea level	621.8 m
Overall height of tower above site elevation	48.8 m
Overall height of tower above mean sea level	670.6 m
Height of antenna radiation center above site elevation	33.5 m
Elevation of average terrain (45-degree-spaced radials, 3.2-16.1 km)	373.7 m
Height of antenna radiation center above mean sea level	655.3 m
Height of antenna radiation center above average terrain (HAAT)	281.6 m

Antenna

Manufacturer	Dielectric
Model	TLP-16J
Description	Side-Mounted, Center-Fed UHF Coaxial Slot
Orientation (rotation around vertical axis)	330° true
Electrical beam tilt	1.0°
Mechanical beam tilt	1.0° down toward 330° true
Polarization	Horizontal
Gain (peak of beam – 1.0° depression, before mechanical tilt)	32.00 (15.05 dB)
Gain (in horizontal plane – 0° depression, after mechanical tilt)	24.672 (13.92 dB)

Power

Effective radiated power (ERP) (main beam – 1.0° depression)	48.0 kW
Effective radiated power (ERP) (horizontal plane)	37.0 kW

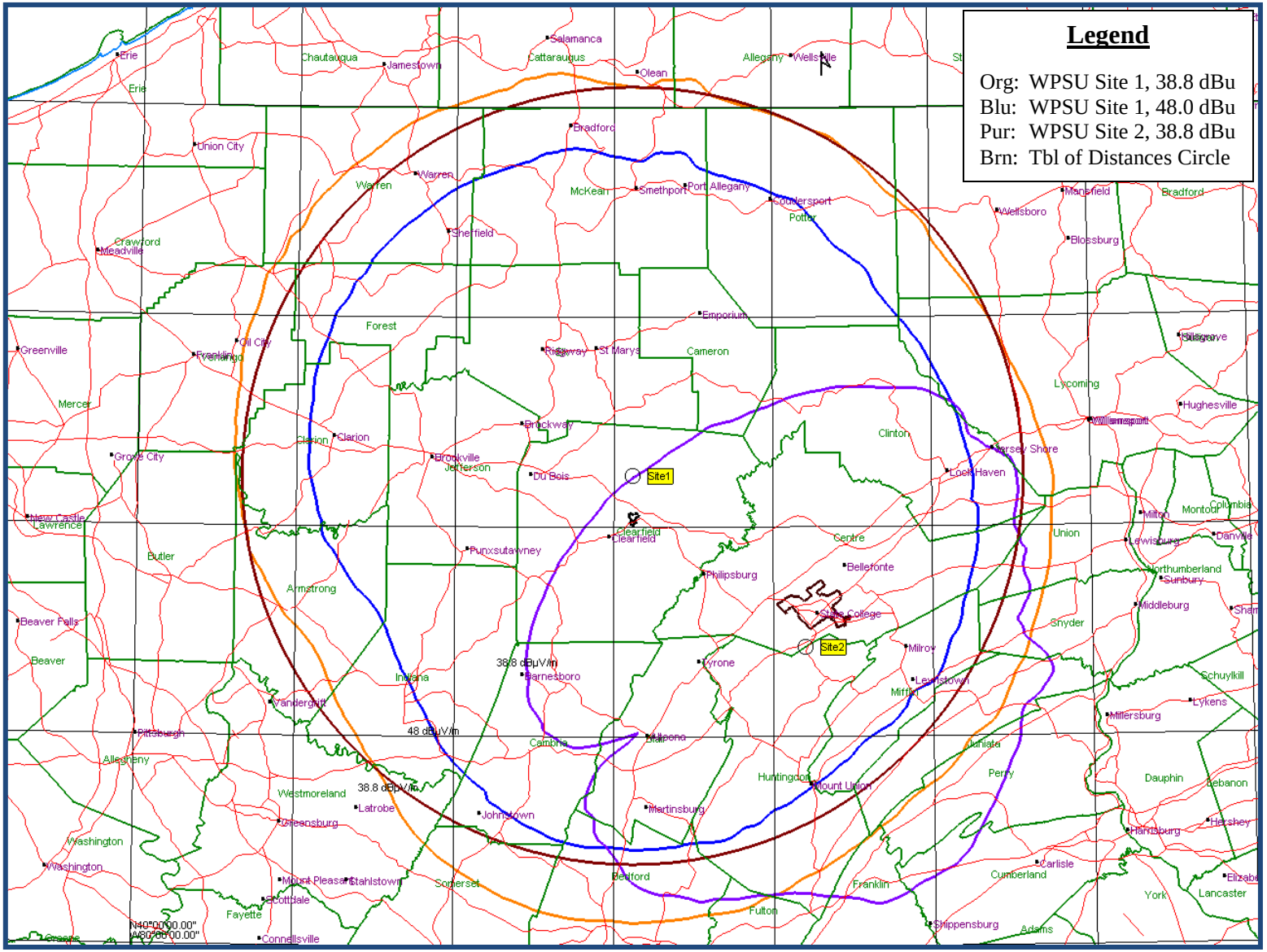

Figure 2 — WPSU DTS Network Predicted Noise-Limited Contours & Table of Distances Circle

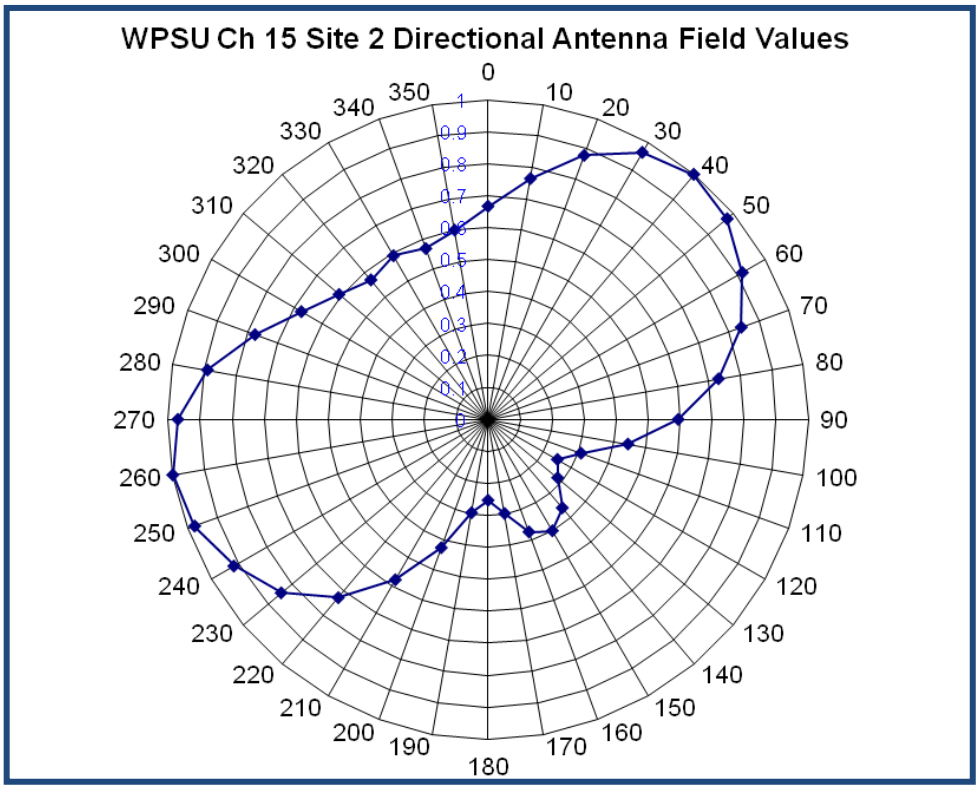

Figure 9 — WPSU Site 2 Antenna Azimuth Relative Field Values

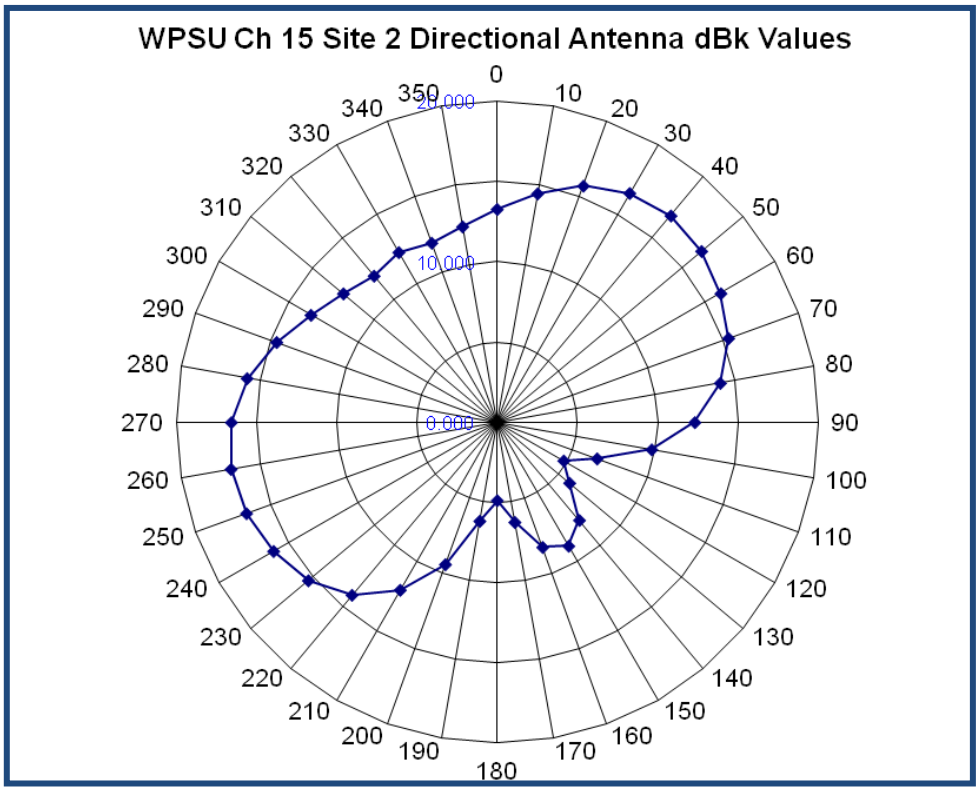

Figure 10 — WPSU Site 2 Antenna Azimuth dBk Values

Figure 11— WPSU Site 2 Azimuthal Radiation Pattern Tabulated Values

Azimuth	Relative Field	Effective Radiated Power (dBk)	Azimuth	Relative Field	Effective Radiated Power (dBk)
0	0.666	13.284	min 180	0.253	4.865
10	0.764	14.478	190	0.296	6.246
20	0.878	15.683	200	0.427	9.419
30	0.964	16.491	210	0.579	12.064
max 40	1.000	16.811	220	0.728	14.049
50	0.975	16.595	230	0.844	15.335
60	0.918	16.067	240	0.917	16.060
70	0.842	15.318	250	0.975	16.594
80	0.731	14.094	max 260	1.000	16.812
90	0.594	12.292	270	0.969	16.539
100	0.444	9.760	280	0.890	15.798
110	0.309	6.614	290	0.775	14.596
min 120	0.250	4.785	300	0.673	13.377
130	0.284	5.880	310	0.608	12.486
140	0.361	7.962	320	0.569	11.916
max 150	0.402	8.895	330	0.591	12.239
160	0.374	8.279	340	0.568	11.902
170	0.299	6.316	350	0.601	12.387

Notes: Derived from data supplied by manufacturer. Complete data set available upon request.

Does not show the effects of mechanical beam tilt, which are included only in the file uploaded within Form 340 on FCC Electronic Filing System

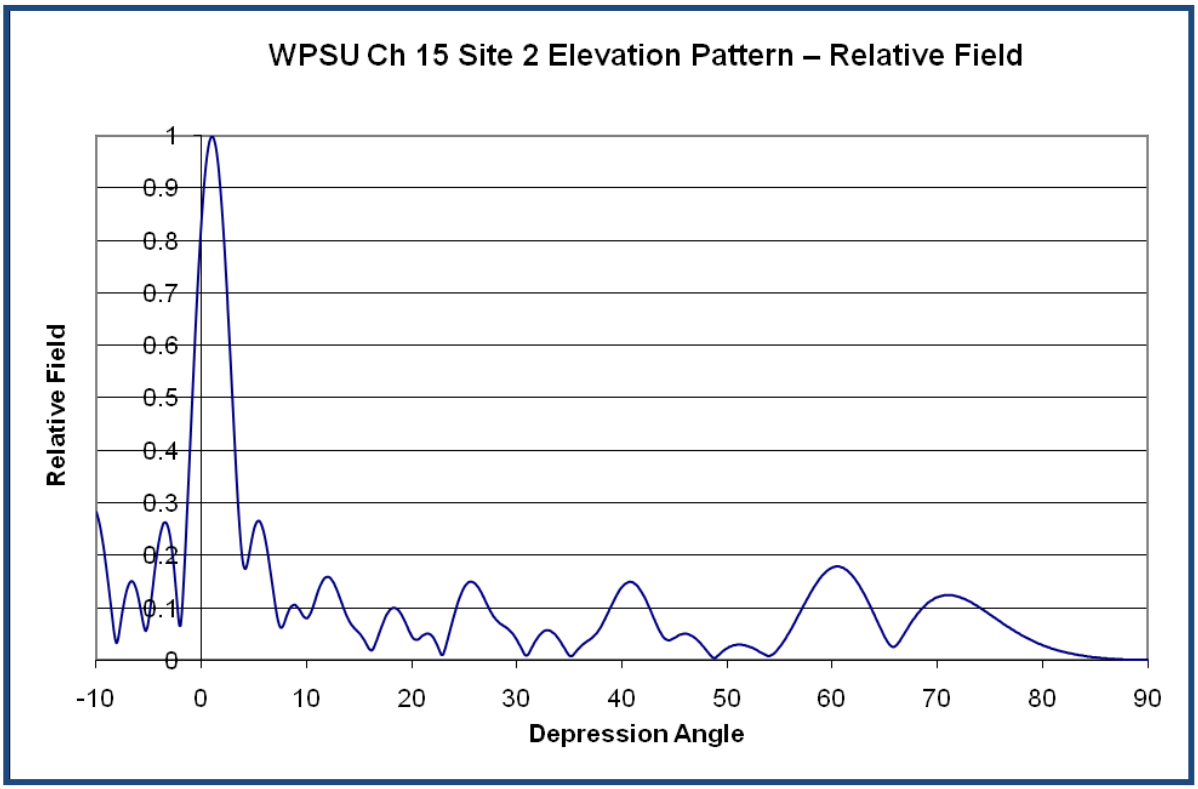

Figure 12 — WPSU Site 2 Antenna Elevation Relative Field Values

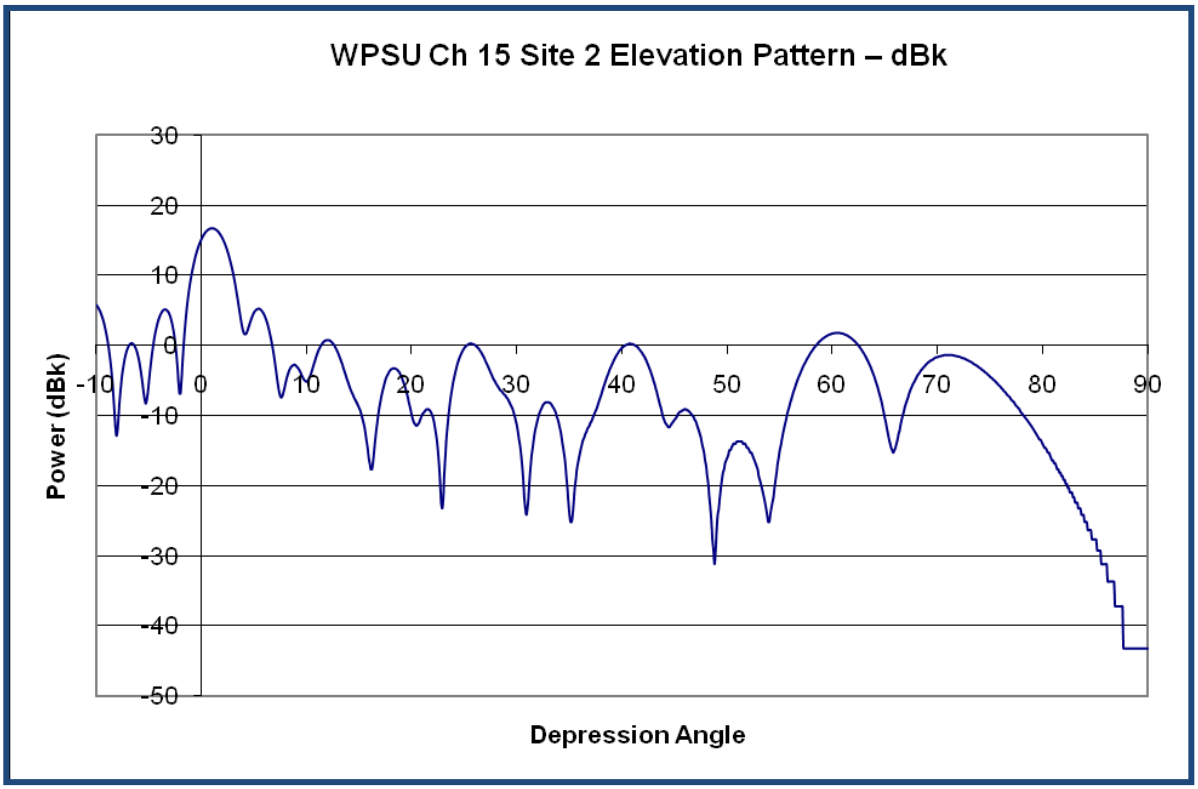

Figure 13 — WPSU Site 2 Antenna Elevation dBk Values

Figure 14 — WPSU Site 2 Elevation Radiation Pattern Tabulated Values

Depression Angle	Relative Field	Effective Radiated Power (dBk)	Depression Angle	Relative Field	Effective Radiated Power (dBk)
-5.0	0.081	-5.018	9.0	0.104	-2.847
-4.5	0.163	1.056	9.5	0.090	-4.103
-4.0	0.233	4.160	10.0	0.080	-5.126
-3.5	0.263	5.212	10.5	0.096	-3.542
-3.0	0.237	4.307	11.0	0.127	-1.112
-2.5	0.150	0.334	11.5	0.151	0.392
-2.0	0.066	-6.797	12.0	0.159	0.840
-1.5	0.228	3.971	12.5	0.150	0.334
-1.0	0.446	9.799	13.0	0.128	-1.043
-0.5	0.661	13.216	13.5	0.100	-3.188
0.0	0.840	15.298	14.0	0.077	-5.458
0.5	0.959	16.449	14.5	0.062	-7.340
1.0	1.000	16.812	15.0	0.052	-8.868
1.5	0.959	16.449	15.5	0.038	-11.592
2.0	0.844	15.339	16.0	0.021	-16.743
2.5	0.673	13.373	16.5	0.030	-13.645
3.0	0.476	10.365	17.0	0.057	-8.070
3.5	0.290	6.060	17.5	0.083	-4.806
4.0	0.180	1.918	18.0	0.098	-3.363
4.5	0.199	2.789	18.5	0.099	-3.275
5.0	0.251	4.806	19.0	0.088	-4.298
5.5	0.266	5.310	19.5	0.067	-6.666
6.0	0.237	4.307	20.0	0.046	-9.932
6.5	0.177	1.772	20.5	0.039	-11.366
7.0	0.107	-2.600	21.0	0.047	-9.746
7.5	0.063	-7.201	21.5	0.051	-9.036
8.0	0.079	-5.235	22.0	0.045	-10.123
8.5	0.102	-3.016	22.5	0.025	-15.229

Notes: Derived from data supplied by manufacturer. Complete data set available upon request.

Does not show the effects of mechanical beam tilt, which are included only in the file uploaded within Form 340 on FCC Electronic Filing System