Facilities

The facilities requested in this application include continued operation at 1000 kW ERP at a height above average terrain of 597 meters at the Quartzite site, operation at almost 170 kW ERP at 879 meters HAAT at Mt Harvard, and operation at 40 kW ERP at 768 meters HAAT at Snow Peak. The currently authorized facility at the Quartzite site meets the requirements of §73.622(f)(5) as it does not exceed "that needed to provide the same geographic coverage area as the largest station within [its] market." The relationships between the parameters in the cases of the added gap-filler transmitters result in power/height combinations that meet the requirements for maximum allowable facilities specified by the formula in §73.622(f)(8)(ii) of the Commission's Rules. The basic characteristics of each of the transmitters proposed in the KHIZ-DT DTS network are given in Figures 1a, 1b, and 1c at the end of this report and in the related DTS Engineering portions of the Form 301 application – one for each transmitter.

Three fundamental antenna designs are proposed for use in the KHIZ-DT DTS network. The Quartzite antenna is a cardioid, end-fed, slotted coaxial design with characteristics primarily intended to provide sufficient gain in both its azimuth and elevation patterns to meet the KHIZ-DT service objectives while permitting a more physically robust antenna to be installed than was originally put into operation by the station. As was noted in the Technical Statement that accompanied the application for the construction permit that this application seeks to modify, the original antenna twice failed physically. Consequently, it was necessary to add azimuth gain by reducing service in an area having little to no population in order to continue providing full service throughout the remainder of the KHIZ-DT service area. This situation and its solution were fully described in that earlier Technical Statement.

The antenna designs at Mt Harvard and Snow Peak (Sites 2 and 3) will be similar, cavity-slot panel arrays, using panels that have azimuth patterns shaped through use of parasitic elements. Each will consist of a total of six panels in a single column. The Mt Harvard pattern will have a single main lobe, while the Snow Peak pattern will have a pair of main lobes in a "peanut" pattern. The azimuth patterns will be rather narrow in their main beams, with a smaller amount of radiation in other directions. A significant amount of electrical beam tilt will be used, with a sharp cut-off of the radiation above the main beam to control the extent of signal projection from each of the antennas, given their very high locations, to permit better control of interference to adjacent regions and within the DTS network. In addition, a small amount of mechanical beam tilt also will be applied to each antenna to position the contours as close to the authorized contour as possible while minimizing projections beyond the authorized contour. The fundamental difference in the elevation patterns of the antennas between the original application and the current amendment is that the radiation pattern cut-off above the main beam is sharper in the amended patterns, i.e., there is a smaller angular distance between the peak of the main beam and the low point of the null above it.

A plot of the PNLCs[5] of the various transmitters, using the amended elevation patterns, is provided in Figure 2. Since the main, Quartzite Mountain transmitter facility authorized by the outstanding construction permit (herein, DTS Site 1) already covers the entire authorized service area of the station,[6] the provisions of §73.626(f)(1) are met by that facility alone. By virtue of the overlap of the contours of the three 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 Barstow, CA. 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. All three transmitters in the proposed DTS network are located within the KHIZ authorized service area, consequently meeting the requirements of §73.626(f)(6).

Although they were filed in the Technical Statement accompanying the original construction permit application that this application now seeks to modify, a description and plots of the pattern characteristics for the DTS Site 1 (Quartzite) antenna nevertheless are reproduced herein. The DTS Site 1 antenna is oriented to place the center of the

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[5] To account for the dipole correction factor, the PNLCs are plotted at 41.5 dBu, with service statistics of F(50,90).

[6] 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."

cardioid azimuth pattern at 218 degrees true. Elevation power gain of the antenna is 23.50 (13.71 dBd) at the vertical beam maximum (1.0 degree below horizontal), 12.10 (10.83 dBd) in the horizontal plane, and 22.02 (13.43 dBd) at 0.677 degree below horizontal, the average depression angle to the radio horizon (computed at 1-degree azimuth intervals). The azimuth power gain is 1.60 (2.04 dB), yielding a total power gain in the main beam of 37.60 (15.75 dBd), in the horizontal plane of 19.36 (12.87 dBd), and toward the radio horizon of 35.23 (15.47 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 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 decibels relative to 1 kW (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.

The antennas for DTS Site 2 (Mt Harvard) and DTS Site 3 (Snow Peak) are similar to one another in their basic designs, the major difference being the azimuth patterns created by the attached parasitic elements. They also have slightly different electrical beam tilt characteristics, with the DTS Site 2 antenna having its main beam at a depression angle of 3.6 degrees, while the DTS Site 3 antenna has its main beam at a depression angle of 3.3 degrees. Each antenna has somewhat different mechanical beam tilt applied in addition to the electrical beam tilt. Their characteristics and orientations are fully described in Figures 1b and 1c. Because mechanical beam tilt will be used and complete elevation data for the antennas for DTS Sites 2 and 3 is being supplied through files input to the CDBS Electronic Filing System, the azimuth pattern plots supplied in this Technical Statement are for reference only and are at right angles to the axes of the antennas at the peaks of their respective main beams (i.e., at 3.6 degrees depression for the Site 2 antenna and at 3.3 degrees depression for Site 3). Consequently, the azimuth patterns and data supplied herein do not take account of the mechanical beam tilt, the effect of which is reflected wholly within the elevation data files provided online.

It should be noted that, while azimuth pattern relative field data and azimuth rotation values were supplied for Sites 2 and 3 in the original, online application form, they have been deleted online in this amendment. As noted in the original Technical Statement, the azimuth pattern data had been supplied to provide insight into the antenna characteristics, but the online filing of that data was found to interfere with the correct determination of the orientation and amplitude characteristics of the pattern in the Commission's processing software, leading to their deletion in the online form as of this amendment and the antenna type being set to "Non-Directional.". The antennas, however, are directional, with the alternate setting being required to make the Commission's input processing software correctly represent the data that describes the antennas. Updated versions of these data continue to be provided in this Technical Statement. It further should be noted that, once the Commission's DTS processing software is complete and 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.

The essential elevation pattern design of the antennas for DTS Sites 2 and 3 is somewhat unusual. It includes main beams at depression angles of 3.6 and 3.3 degrees, with a rapid fall-off of relative field values above the main beams to deep nulls at depression angles of 0.8 and 0.5 degrees, respectively. The nulls serve two purposes: They help to control the locations of the contours while permitting stronger field strengths to be delivered within the service areas, and they help in controlling interference to stations in neighboring markets. The latter consideration is significant in the discussion below on Border Issues. The elevation pattern design also includes a relatively broad peak and significant power levels to depression angles of approximately 17 degrees, thereby providing strong signals to the areas below the mountains on which the gap-filler transmitters are situated.

Elevation power gain of the antenna design for DTS Site 2 is 8.53 (9.31 dBd) at the beam maximum (3.6 degrees below horizontal), less than 0.001 (–30 dBd) at the null above the main beam (0.8 degrees below horizontal), and 0.16 (–7.97 dBd) in the horizontal plane. The azimuth power gain is 5.70 (7.56 dB), yielding a total power gain in the main beam of 48.64 (16.87 dBd) and of 0.91 (–0.41 dBd) in the horizontal plane. All plane and depression angle values are with respect to the antenna axis prior to the effects of any mechanical beam tilt.

Equivalent characteristics for the DTS Site 3 antenna are elevation power gain of 8.57 (9.33 dBd) at the beam maximum (3.3 degrees below horizontal), less than 0.001 (–30 dBd) at the null above the main beam (0.5 degrees below horizontal), and 0.145 (–8.38 dBd) in the horizontal plane. The azimuth power gain is 2.88 (4.59 dB), yielding a total power gain in the main beam of 24.89 (13.96 dBd) and of 0.418 (–3.79 dBd) in the horizontal plane. All plane and depression angle values are with respect to the antenna axis prior to the effects of any mechanical beam tilt. Because of the mechanical beam tilt applied to this antenna, effective radiated power toward the radio horizon is an inappropriate parameter for this antenna and therefore is not provided.

Plots of the DTS Sites 2 and 3 antenna azimuthal radiation patterns in relative field values are included as Figures 9a and 9b. The azimuthal power patterns expressed in decibels relative to 1 kW (dBk), at the depression angles having maximum power (3.6and 3.3 degrees depression, respectively), are plotted in Figures 10a and 10b. The tabulated azimuthal field and power values are given in Figures 11a and 11b. The elevation radiation patterns in relative field values are included as Figures 12a and 12b. The elevation power patterns expressed in decibels relative to 1 kW (dBk), in the azimuthal directions having maximum power, are plotted in Figures 13a and 13b. The tabulated elevation field and power values are given in Figures 14a and 14b. All of these plots and tables are 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 each antenna has been uploaded to the CDBS Electronic Filing System (EFS) web site in array form in Office Open XML format, with the first columns containing depression angle values and the first rows containing azimuth values for each column.

Although only a single elevation pattern applies to each of the antennas for DTS Sites 2 and 3, mechanical beam tilt will be applied to each of them. Since, as described above, the software that the Commission will use to evaluate this application is not yet capable of applying mechanical beam tilt, the pattern rotation implicit in mechanical beam tilt has been pre-applied to the data provided through the EFS. Consequently, a large array of elevation data has been supplied for each antenna. Correspondingly, the Forms 301 DTS have been marked that no mechanical beam tilt and, similarly, that no azimuth rotation is applicable because they already have been built into the data arrays uploaded with the application forms. The actual azimuth rotations and mechanical beam tilt angles and headings for the antennas at DTS Sites 2 and 3 are provided in Figures 1b and 1c below.

All of the transmitters to be used in the KHIZ-DT DTS network will be Type Verified as per Section 73.1660 of the Commission's Rules. The new gap-filler transmitters will be of solid state designs, while the existing transmitter at Site 1 will remain an Inductive Output Tube (IOT) type. They will be synchronized using the methods specified in the ATSC Synchronization Standard for Distributed Transmission (A/110B), and they will emit the RF Watermark transmitter identification signal defined in the A/110B document.

Largest In Market Calculation

As noted above, §73.622(f)(5) provides that stations may exceed the limits on power and antenna height included in §73.622(f)(6) through (8) "up to that needed to provide the same geographic coverage area as the largest station within their market." The DTS R&O applies the same exception to DTS operations. In ¶35 "Largest Station" Alternative, it states, "As an alternative to the Table of Distances Approach for determining the hypothetically maximized service area, full-power stations may use the 'largest station' provision in section 73.622(f)(5) of the rules."[7]

[7] *Digital Television Distributed Transmission System Technologies*, Report and Order, MB Docket No. 05-312 (FCC 08-256, released November 7, 2008) ¶35.

Figure 1a — Technical Specifications — Proposed KHIZ-DTS Facility
Channel 44 — Barstow, CA — Site 1: Quartzite Mtn

Frequency

Channel	44
Frequency Band	650 – 656 MHz
Center Frequency	653 MHz

Location

Site	Quartzite Mountain, Victorville, CA
Geographic Coordinates (NAD27)	34° 36’ 33.93” N 117° 17’ 10.94” W
Tower Registration (FAA Study Number)	1014642 (2002-AWP-2863-OE)

Elevation

Elevation of site above mean sea level	1367.6 m
Overall height of tower above site elevation	156.0 m
Overall height of tower above mean sea level	1523.6 m
Height of antenna radiation center above site elevation	146.0 m
Elevation of average terrain (45-degree-spaced radials, 3.2-16.1 km)	916.7 m
Height of antenna radiation center above mean sea level	1513.6 m
Height of antenna radiation center above average terrain (HAAT)	596.9 m

Antenna

Manufacturer	Electronics Research, Inc.
Model	ATW24H4-HSCX-44H
Description	Side-Mounted UHF Slot
Orientation (rotation around vertical axis)	218° true
Electrical beam tilt	1.0°
Mechanical beam tilt	None
Polarization	Horizontal
Gain (in horizontal plane – 0° depression)	19.36 (12.87 dBd)
Gain (peak of beam – 1.0° depression)	37.60 (15.75 dBd)

Power

Effective radiated power (ERP) (main beam – 1.0° depression)	1000 kW
Effective radiated power (ERP) (toward avg. radio horizon – 0.677° dn.)	937 kW
Effective radiated power (ERP) (horizontal plane)	515 kW

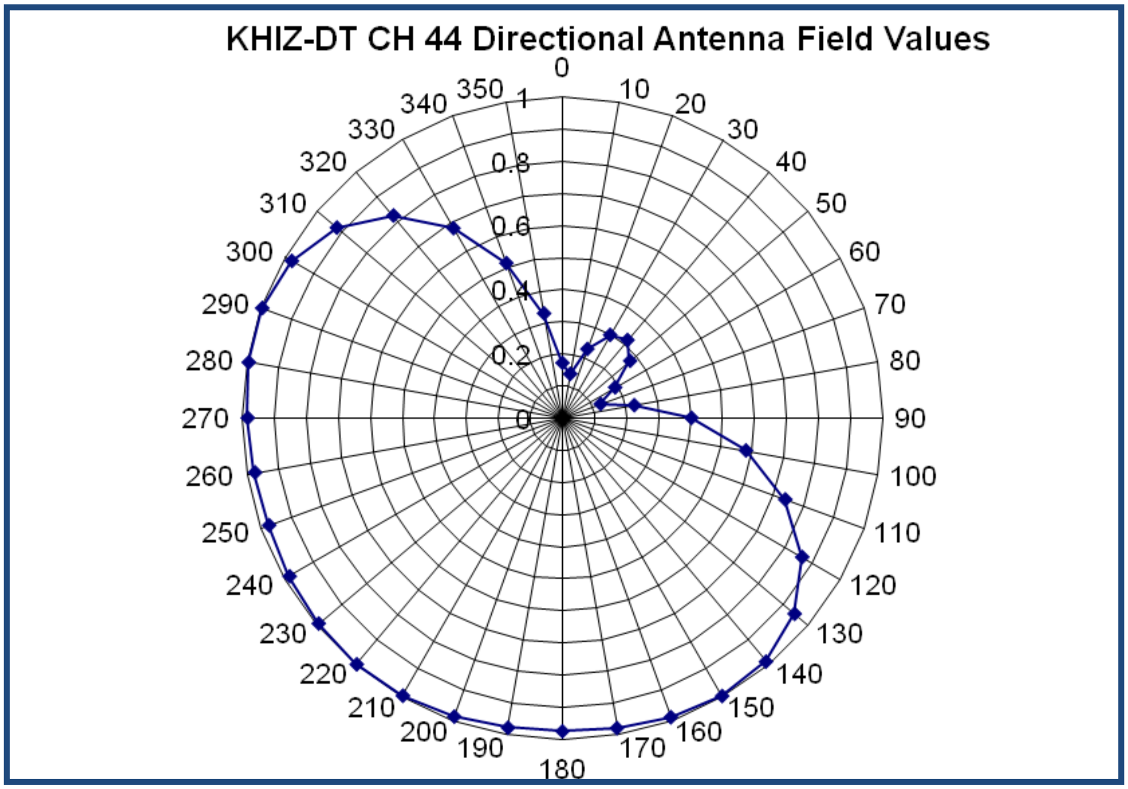

Figure 3 — KHIZ-DT Site 1 Azimuth Pattern in Relative Field Values

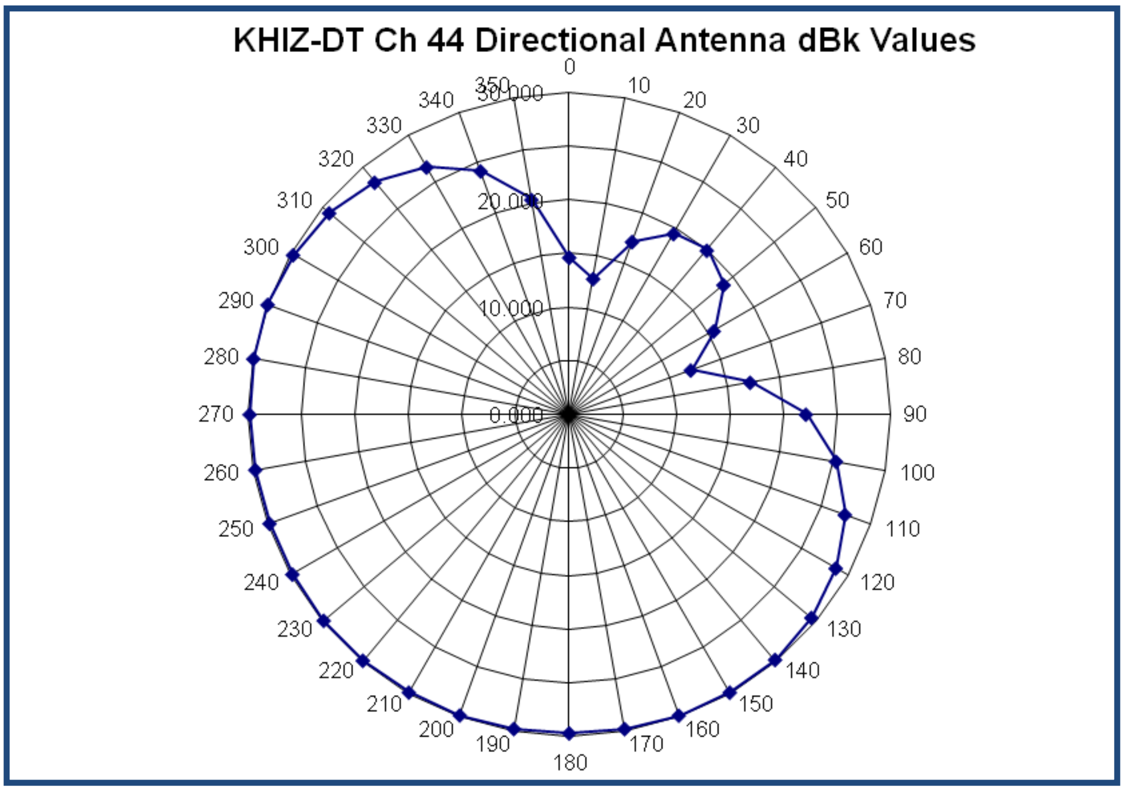

Figure 4 — KHIZ-DT Site 1 Azimuth Pattern in dBk

Figure 5 — KHIZ-DT Site 1 Azimuthal Radiation Pattern Tabulated Values

Azimuth	Relative Field	Effective Radiated Power (dBk)	Azimuth	Relative Field	Effective Radiated Power (dBk)
0	0.171	14.660	180	0.974	29.771
min 6	0.127	12.076	190	0.978	29.807
10	0.139	12.860	200	0.988	29.895
20	0.228	17.159	210	0.997	29.974
30	0.298	19.484	max 218	1.000	30.000
max 38	0.317	20.021	220	1.000	30.000
40	0.316	19.994	230	0.994	29.948
50	0.276	18.818	240	0.984	29.860
60	0.190	15.575	250	0.975	29.780
min 70	0.127	12.076	260	0.975	29.780
80	0.228	17.159	270	0.983	29.851
90	0.403	22.106	280	0.995	29.956
100	0.582	25.298	290	0.998	29.983
110	0.741	27.396	300	0.976	29.789
120	0.865	28.740	310	0.920	29.276
130	0.947	29.527	320	0.821	28.287
140	0.989	29.904	330	0.681	26.663
150	0.998	29.983	340	0.512	24.185
160	0.990	29.913	350	0.330	20.370
170	0.979	29.816			

Derived from data supplied by manufacturer

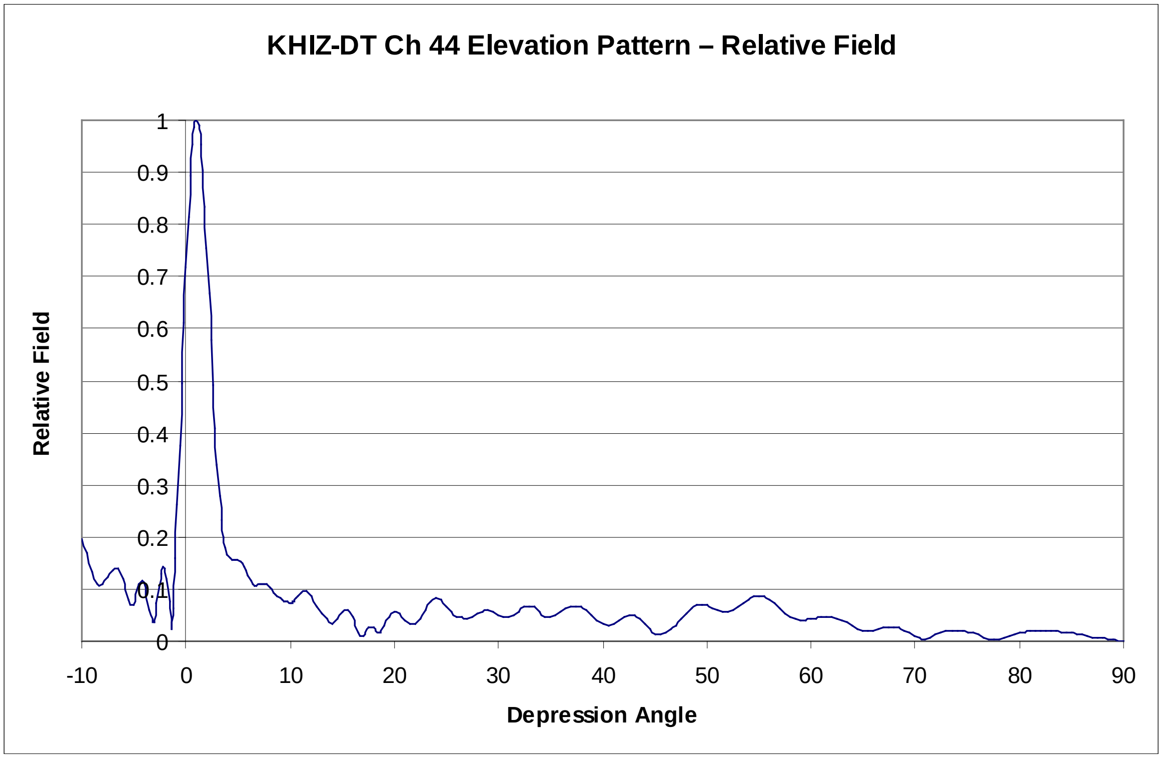

Figure 6 — KHIZ-DT Site 1 Elevation Pattern in Relative Field Values

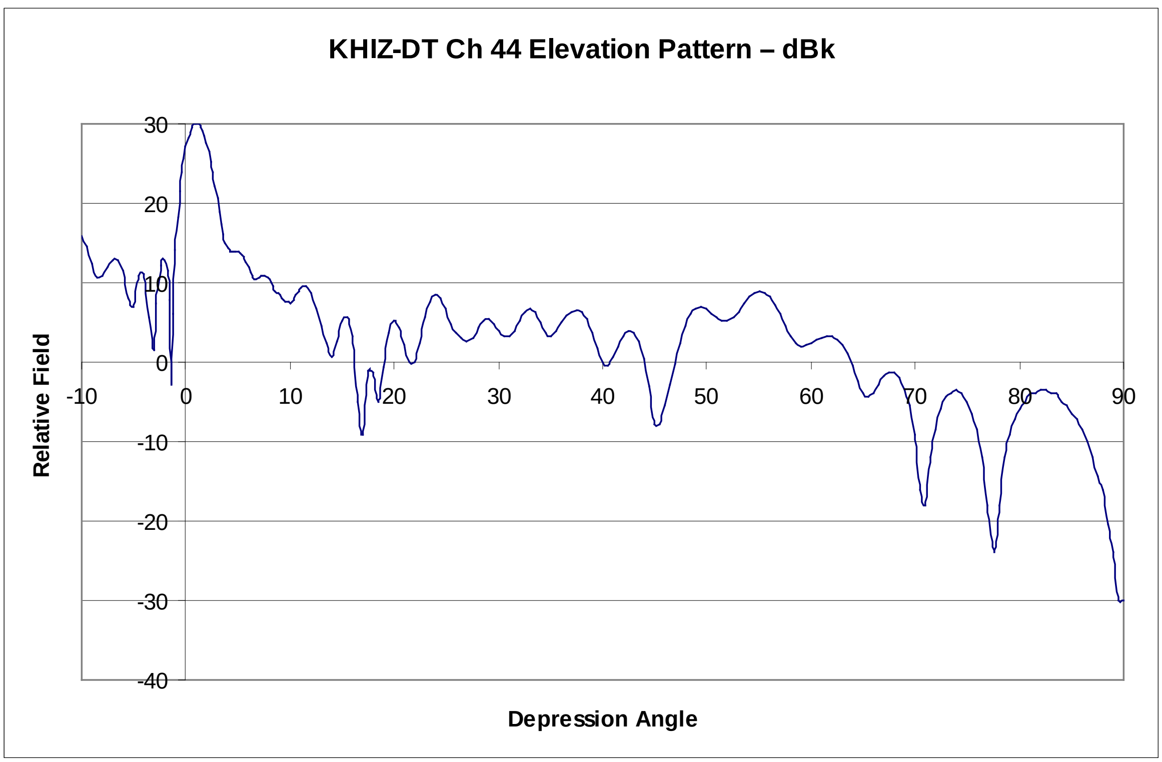

Figure 7 — KHIZ-DT Site 1 Elevation Pattern in dBk (at Azimuth w/Maximum)

Figure 8 — KHIZ-DT Site 1 Elevation Radiation Pattern Tabulated Values

Depression Angle	Relative Field	Effective Radiated Power (dBk)	Depression Angle	Relative Field	Effective Radiated Power (dBk)
-5.0	0.070	6.902	9.0	0.083	8.382
-4.5	0.110	10.828	9.5	0.077	7.729
-4.0	0.113	11.062	10.0	0.074	7.385
-3.5	0.061	5.707	10.5	0.081	8.112
-3.0	0.038	1.596	11.0	0.092	9.276
-2.5	0.118	11.392	11.5	0.096	9.645
-2.0	0.139	12.860	12.0	0.086	8.690
-1.5	0.051	2.538	12.5	0.068	6.650
-1.0	0.160	14.082	13.0	0.053	4.486
-0.5	0.436	22.701	13.5	0.042	2.465
0.0	0.718	27.122	14.0	0.034	0.630
0.5	0.923	29.295	14.5	0.043	2.669
1.0	1.000	30.000	15.0	0.058	5.269
1.5	0.929	29.357	15.5	0.061	5.707
2.0	0.754	27.547	16.0	0.046	3.255
2.5	0.535	24.530	16.5	0.018	-4.895
3.0	0.339	20.604	17.0	0.011	-9.172
3.5	0.217	16.702	17.5	0.028	-1.057
4.0	0.165	14.350	18.0	0.027	-1.373
4.5	0.155	13.807	18.5	0.018	-4.895
5.0	0.156	13.862	19.0	0.029	-0.752
5.5	0.147	13.345	19.5	0.048	3.625
6.0	0.126	12.007	20.0	0.057	5.117
6.5	0.108	10.667	20.5	0.052	4.320
7.0	0.108	10.668	21.0	0.041	2.256
7.5	0.111	10.906	21.5	0.032	0.103
8.0	0.104	10.341	22.0	0.032	0.103
8.5	0.092	9.225	22.5	0.042	2.465

Note: Partial listing, derived from data supplied by manufacturer. A more complete data set, meeting the requirements spelled out in the form, is included in the file uploaded in Form 301 to the Commission's Electronic Filing System.