Facilities

The facilities requested in this application include continued operation at 665 kW ERP at a height above average terrain of 991 meters at the Mt Wilson site, operation at 50 kW ERP at 696.5 meters HAAT at Table Mountain, and operation at 25.1 kW at 588.5 meters HAAT and at 16.74 kW at 568.5 meters HAAT at Oat Mountain. The currently authorized facility at the Mt Wilson site meets the requirements of §73.622(f)(5), as its combination of power and antenna height does not produce a predicted noise-limited contour the area of which exceeds that of the largest such area produced by another station in the same market. The relationships between the parameters in the cases of the gap-filler transmitters result in power/height combinations that meet the requirements for maximum allowable facilities specified by the table in §73.622(f)(8)(i) of the Commission's Rules. The basic characteristics of each of the transmitters proposed in the KNBC DTS network are given in Figures 1a, 1b, 1c, and 1d at the end of this Technical Statement 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 KNBC DTS network. The Mt Wilson (DTS Site 1) antenna is a relatively conventional, omnidirectional, center-fed, slotted coaxial design. It has one degree of electrical beam tilt and is installed with one degree of mechanical beam tilt downward toward 215 degrees. It has been in service for KNBC since the station first initiated digital transmission in 1998.

The antenna design at the Table Mountain site (DTS Site 2) will be a panel array, using broadband panels and a corporate feed. It will consist of a total of sixteen panels in two columns of eight each and will have three main lobes in its azimuth pattern. A significant amount of electrical beam tilt will be used, with a substantial notch in the radiation above the main beam. The combination of the electrical beam tilt and the notch will permit the application of mechanical beam tilt to the antenna in such a way that the forward lobes will be oriented to a relatively conventional depression angle (0.7 degrees), while the back lobes will be driven into the ground, with the notch occurring at a depression angle that will permit substantial reduction in power toward a nearby scientific installation. This combination of factors is discussed in more detail below.

The antenna designs at the Oat Mountain site will be relatively simple, single-column arrays of six panels and four panels each for DTS Sites 3 and 4, respectively. Each will have a single main lobe in its azimuth pattern. No electrical beam tilt will be used, with only mechanical beam tilt applied to control the extent of signal projection from the antennas.

A plot of the proposed PNLCs[5] of the four transmitters is provided in Figure 2, where the existing Site 1 contour is in orange, the proposed Site 2 contour is in olive, the proposed Site 3 contour is in green, and the proposed Site 4 contour is in violet. In its current configuration, the main, Mt Wilson transmitter facility authorized by the existing construction permit (herein, DTS Site 1) already covers the entire authorized service area of the station;[6] thus, the requirements of §73.626(f)(1) would be met by that facility alone. By virtue of the overlap of the contours of the transmitters, they are contiguous, thereby meeting the requirements of §73.626(f)(3). Also shown in Figure 2, in blue, is the 48 dBu contour of the DTS Site 1 facility, which can be seen to encompass the entire County of Los Angeles, CA, in which is located the City of Los Angeles, to which KNBC is licensed. All four transmitters in the proposed DTS network are located within the KNBC "Largest Station" Alternative to the Table of Distances area (discussed in detail below), consequently meeting the requirements of §73.626(f)(6).

The characteristics of the DTS Site 1 (Mt Wilson) facility are fully described in Figure 1a. The antenna is installed with 1 degree of mechanical beam tilt downward in the direction of 215 degrees true. The antenna has elliptical polarization, with 16.67 percent of the power applied to the vertical polarization component. Elevation power gain of the antenna is 13.80 (11.38 dBd) in the horizontal polarization component and 2.80 (4.39 dBd) in the vertical polarization component at the vertical beam maximum (1.0 degree below the plane orthogonal to the axis of the antenna and through its radiation center). Azimuth power gain of the antenna in the horizontal polarization component is virtually

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[5] To account for the dipole correction factor, the PNLCs are plotted at 40.9 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."

nil (1.023 or 0.10 dBd). The mechanical beam tilt causes the gain of the horizontal polarization component to vary in the horizontal plane between 13.80 (11.38 dBd) at 35 degrees azimuth and 8.79 (9.44 dBd) at 215 degrees azimuth.

A plot of the azimuthal radiation pattern of the DTS Site 1 antenna in relative field values of the horizontal polarization component, prior to the application of mechanical beam tilt, (i.e., 1 degree below the plane orthogonal to the axis of the antenna and through its radiation center) is included as Figure 3. The azimuthal radiation pattern in relative field values of the horizontal polarization component in the horizontal plane, after application of mechanical beam tilt, is included as Figure 4.[7] The azimuthal power pattern of the horizontal polarization component, expressed in decibels relative to 1 kW (dBk), prior to the application of mechanical beam tilt, (i.e., 1 degree below the plane orthogonal to the axis of the antenna and through its radiation center) is included as Figure 5. The azimuthal power pattern of the horizontal polarization component, expressed in decibels relative to 1 kW (dBk) in the horizontal plane, is plotted in Figure 6. Tabulated azimuthal field and power values of the horizontal polarization component derived from the data arrays used to generate Figures 3 through 6 are given in Figure 7. The elevation radiation pattern in relative field values of the horizontal polarization component along the axis of the antenna is included as Figure 8. The elevation power pattern of the horizontal polarization component, expressed in decibels relative to 1 kW (dBk) along the axis of the antenna, is plotted in Figure 9. Tabulated elevation field and power values of the horizontal polarization component derived from the data arrays used to generate Figures 8 &9 are given in Figure 10.

Because of the mechanical beam tilt applied to the Site 1 antenna, its elevation pattern varies with azimuth, and its azimuth pattern varies with depression angle. Therefore, complete pattern data for the antenna for DTS Site 1 is being supplied through a complex elevation pattern data file uploaded to the CDBS Electronic Filing System. In that file, depression angle values are included in the first column, and azimuth values are included

[7] Figures 4 & 6, which include the effects of mechanical beam tilt on the pattern in the horizontal plane, are included for purposes of comparison with earlier filings with respect to the Mt Wilson facility. The full set of data with mechanical beam tilt applied is included only in the complex elevation pattern uploaded to the CDBS Electronic Filing System as part of the Form 301 DTS application.

in the first row. The azimuth and elevation pattern plots and tabular data supplied in this Technical Statement are for reference only and are intended to help in visualization of the characteristics of the antenna. Full specification of the antenna pattern is contained wholly and only within the elevation pattern data file uploaded with the Form 301 application.

It should be noted that, due to limitations in the Form 301 DTS Engineering pages in the CDBS Electronic Filing System (EFS) and because the values in the azimuth pattern relative field data input there are multiplied by the data in the elevation pattern data file in the Commission's processing software, it is not possible to enter data into the azimuth pattern input fields that are representative of the horizontal plane pattern subsequent to inclusion of the effects of mechanical beam tilt. Doing so would result in distortion of the actual pattern data and lead to incorrect analyses of the predicted interference from or to a station under study. Moreover, since the Commission's processing software does not have the ability to apply mechanical beam tilt to more than one antenna in a study and does not currently apply mechanical tilt in a non-distorting way to an antenna pattern, it is necessary to put data representing the radiation pattern of each antenna subsequent to application of mechanical tilt into the corresponding uploaded elevation pattern data file, which is the only available mechanism that has sufficient data representation capacity to carry the required amount of data. As a result of all of this, it is necessary either to set the check box related to the azimuth pattern input fields to "N/A," which parenthetically also indicates "Non-Directional," or not to check the "N/A" box but to put values of 1.000 in all of the azimuth pattern data fields. The latter approach at least indicates that the antenna is directional and therefore was taken in the instant application for each of the DTS Sites and their antenna patterns.

The proposed DTS Site 2 (Table Mountain) antenna will have columns of panels facing 62 and 327 degrees true, with resulting major azimuth lobes at 15, 61, and 328 degrees true. It will have an elevation pattern with its main lobe 3 degrees below the plane orthogonal to the axis of the antenna and through its radiation center. The elevation pattern also will contain a notch above the main lobe at 0.2 degree above the plane orthogonal to the axis of the antenna and through its radiation center. Mechanical beam tilt of 2.3 degrees downward will be applied to the antenna at a bearing of 204 degrees true. This will result in the main beam being lifted to a depression angle of 0.7 degrees toward a bearing of 24 degrees true and being pushed down to a depression angle of 5.3 degrees at the 204-degree bearing. It also will result in the notch above the main beam being pushed down to a depression angle of 2.1 degrees at the 204-degree bearing.

The characteristics and parameters of DTS Site 2 are fully described in Figure 1b. The DTS Site 2 antenna will have circular polarization, with equal power applied to both the horizontal and vertical polarization components; thus the effective radiated power of each individual component is based on half the power input to the antenna. Elevation power gain of the antenna design for DTS Site 2, at the azimuth of beam maximum (61 degrees) and in each of the horizontal and vertical polarization components, is 12.90 (11.12 dBd) at the beam maximum (3.0 degrees below the plane orthogonal to the axis of the antenna and through its radiation center) and just over 0.0029 (–25.36 dBd) at the null above the main beam (0.2 degrees above the plane orthogonal to the axis of the antenna and through its radiation center). The azimuth power gain, at the depression angle of beam maximum (3.0 degrees below the plane orthogonal to the axis of the antenna and through its radiation center) and in each of the horizontal and vertical polarization components is 2.90 (4.62 dB). The total power gain in each of the horizontal and vertical polarization components in the main beam is 37.41 (15.73 dBd). The mechanical beam tilt causes the gain of each of the horizontal and vertical polarization components to vary in the horizontal plane between 23.61 (13.73 dBd) at 53 degrees azimuth and 0.000002647 (-55.77 dBd) at 194 degrees azimuth.

A plot of the DTS Site 2 antenna azimuthal radiation pattern in relative field values, at the depression angle having maximum field (3.0 degrees below the plane orthogonal to the axis of the antenna and through its radiation center), is included as Figure 11. The azimuthal power pattern expressed in decibels relative to 1 kW (dBk), at the depression angle having maximum power (also 3.0 degrees below the plane orthogonal to the axis of the antenna and through its radiation center), is plotted in Figure 12. The tabulated azimuthal field and power values are given in Figure 13. The elevation radiation pattern in relative field values along the axis of the antenna, in the azimuthal direction having maximum field (61 degrees), is included as Figure 14. The elevation power pattern expressed in decibels relative to 1 kW (dBk) along the axis of the antenna, in the azimuthal direction having maximum power (also 61 degrees), is plotted in Figure 15. The tabulated elevation field and power values are given in Figure 16.

Because of the mechanical beam tilt applied to the DTS Site 2 antenna, its elevation pattern varies with azimuth, and its azimuth pattern varies with depression angle. Therefore, complete pattern data for the antenna for DTS Site 2 are being supplied through a complex elevation pattern data file uploaded to the CDBS Electronic Filing System. In that file, depression angle values are included in the first column, and azimuth values are included in the first row. The azimuth and elevation pattern plots and tabular data supplied in this Technical Statement are for reference only and are intended to help in visualization of the characteristics of the antenna. Full specification of the antenna pattern is contained wholly and only within the elevation pattern data file uploaded with the Form 301 application. It should be noted that the limitations of the CDBS EFS Form 301 DTS Engineering web page regarding inclusion of azimuth pattern relative field values and the related check box, described above with respect to the DTS Site 1 antenna, apply equally with respect to the DTS Site 2 antenna and that the same approach taken for Site 1 has been followed for Site 2.

The proposed DTS Sites 3 and 4 antennas (both of which will be at Oat Mountain) will be composed of single columns of panels – 6 for DTS Site 3 and 4 for DTS Site 4. There will be no electrical beam tilt applied to the elevation pattern of either antenna; only mechanical beam tilt will be applied to each of them. The DTS Site 3 antenna will be oriented with its main beam toward an azimuth of 255 degrees true and 1.5 degrees below the horizontal at the same heading. The DTS Site 4 antenna will be mounted 20 meters below the DTS Site 3 antenna on the same tower. It will be oriented with its main beam toward an azimuth of 15 degrees and 2.0 degrees below the horizontal at the same heading.

The characteristics and parameters of DTS Sites 3 and 4 are fully described in Figures 1c and 1d, respectively. Their antennas will have circular polarization, with equal power applied to both the horizontal and vertical polarization components; thus, the effective radiated power of each individual component is based on half the power input to its respective antenna. Elevation power gain of the antenna design for DTS Site 3, at the azimuth of beam maximum (255 degrees) and in each of the horizontal and vertical polarization components, is 14.24 (11.54 dBd) at the beam maximum (in the plane orthogonal to the axis of the antenna and through its radiation center). The azimuth power gain, at the depression angle of beam maximum (in the plane orthogonal to the axis of the antenna and through its radiation center) and in each of the horizontal and vertical polarization components is 5.63 (7.51 dB). The total power gain in each of the horizontal and vertical polarization components in the main beam is 80.17 (19.04 dBd). The mechanical beam tilt causes the gain of each of the horizontal and vertical polarization components to vary in the horizontal plane between 53.80 (17.31 dBd) at 255 degrees azimuth and 0.27878 (-5.55 dBd) at both 43 and 107 degrees azimuth.

Elevation power gain of the antenna design for DTS Site 4, at the azimuth of beam maximum (15 degrees) and in each of the horizontal and vertical polarization components, is 9.50 (9.78 dBd) at the beam maximum (in the plane orthogonal to the axis of the antenna and through its radiation center). The azimuth power gain, at the depression angle of beam maximum (in the plane orthogonal to the axis of the antenna and through its radiation center) and in each of the horizontal and vertical polarization components is 5.63 (7.51 dB). The total power gain in each of the horizontal and vertical polarization components in the main beam is 53.49 (17.28 dBd). The mechanical beam tilt causes the gain of each of the horizontal and vertical polarization components to vary in the horizontal plane between 38.83 (15.89 dBd) at 15 degrees azimuth and 0.1965 (-7.07 dBd) at both 163 and 227 degrees azimuth.

Plots of the azimuthal radiation patterns of the DTS Sites 3 & 4 antennas in relative field values, at the depression angles having maximum field (in the planes orthogonal to the axes of the antennas and through their radiation centers), are included as Figures 17a and 17b. The azimuthal power patterns expressed in decibels relative to 1 kW (dBk), at the depression angles having maximum power (also in the planes orthogonal to the axes of the antennas and through their radiation centers), are plotted in Figures 18a and 18b. The tabulated azimuthal field and power values for the DTS Sites 3 & 4 antennas are given in Figure 19. The elevation radiation patterns in relative field values along the axes of the antennas, in the azimuthal directions having maximum field (255 and 15 degrees for DTS Sites 3 & 4, respectively), are included as Figures 20a and 20b. The elevation power patterns expressed in decibels relative to 1 kW (dBk) along the axes of the antennas, in the azimuthal directions having maximum power (also 255 and 15 degrees for DTS Sites 3 & 4, respectively), are plotted in Figures 21a and 21b. The tabulated elevation field and power values are given in Figure 22.

Because of the mechanical beam tilt applied to the DTS Sites 3 & 4 antennas, their elevation patterns vary with azimuth, and their azimuth patterns vary with depression angle. Therefore, complete pattern data for the antennas for DTS Sites 3 & 4 are being supplied through complex elevation pattern data files uploaded to the CDBS Electronic Filing System. In those files, depression angle values are included in the first columns, and azimuth values are included in the first rows. The azimuth and elevation pattern plots and tabular data supplied in this Technical Statement are for reference only and are intended to help in visualization of the characteristics of the antennas. Full specifications of the antenna patterns are contained wholly and only within the elevation pattern data files uploaded with the Form 301 application. It should be noted that the limitations of the CDBS EFS Form 301 DTS Engineering web pages regarding inclusion of azimuth pattern relative field values and the related check boxes, described above with respect to the DTS Site 1 antenna, apply equally with respect to the DTS Sites 3 & 4 antennas and that the same approach taken for Site 1 has been followed for Sites 3 & 4.

All of the transmitters to be used in the KNBC DTS network will be Type Verified as per §73.1660 of the Commission’s Rules. All transmitters will be synchronized, emitting identical symbols on precisely the same frequency; they will transmit the RF Watermark transmitter identification signal defined in the ATSC A/110 transmitter synchronization standard.

Figure 1a — Technical Specifications — Proposed KNBC DTS Facility
Channel 36 — Los Angeles, CA — Site 1: Mt Wilson

Frequency

Channel	36
Frequency Band	602 – 608 MHz
Center Frequency	605 MHz

Location

Site	Mt Wilson, CA
Geographic Coordinates (NAD27)	34° 13’ 32.00” N 118° 03’ 52.00” W
Tower Registration (FAA Study Number)	1026532 (1998-AWP-1515-OE)

Elevation

Elevation of site above mean sea level	1731.0 m
Overall height of tower above site elevation	166.0 m
Overall height of tower above mean sea level	1897.0 m
Height of antenna radiation center above site elevation	160.0 m
Elevation of average terrain (45-degree-spaced radials, 3.2-16.1 km)	900.0 m
Height of antenna radiation center above mean sea level	1891.0 m
Height of antenna radiation center above average terrain (HAAT)	991.0 m

Antenna

Manufacturer	Dielectric
Model	TFU-18GTH/VP-R O6
Description	Top-Mounted, Center-Fed, UHF Slot
Orientation (rotation around vertical axis)	N/A (Omnidirectional)
Electrical beam tilt	1.00°
Mechanical beam tilt	1.0° down toward 215° azimuth
Polarization	Elliptical
Gain (peak of beam – 1.00° depression – Hpol)	13.80 (11.38 dBd)
Gain (peak of beam – 1.00° depression – Vpol)	2.80 (4.39 dBd)

Power

Effective radiated power (ERP) (main beam – 1.0° depression – Hpol)	665.0 kW
Effective radiated power (ERP) (horizontal plane – 35° azimuth – Hpol)	665.0 kW

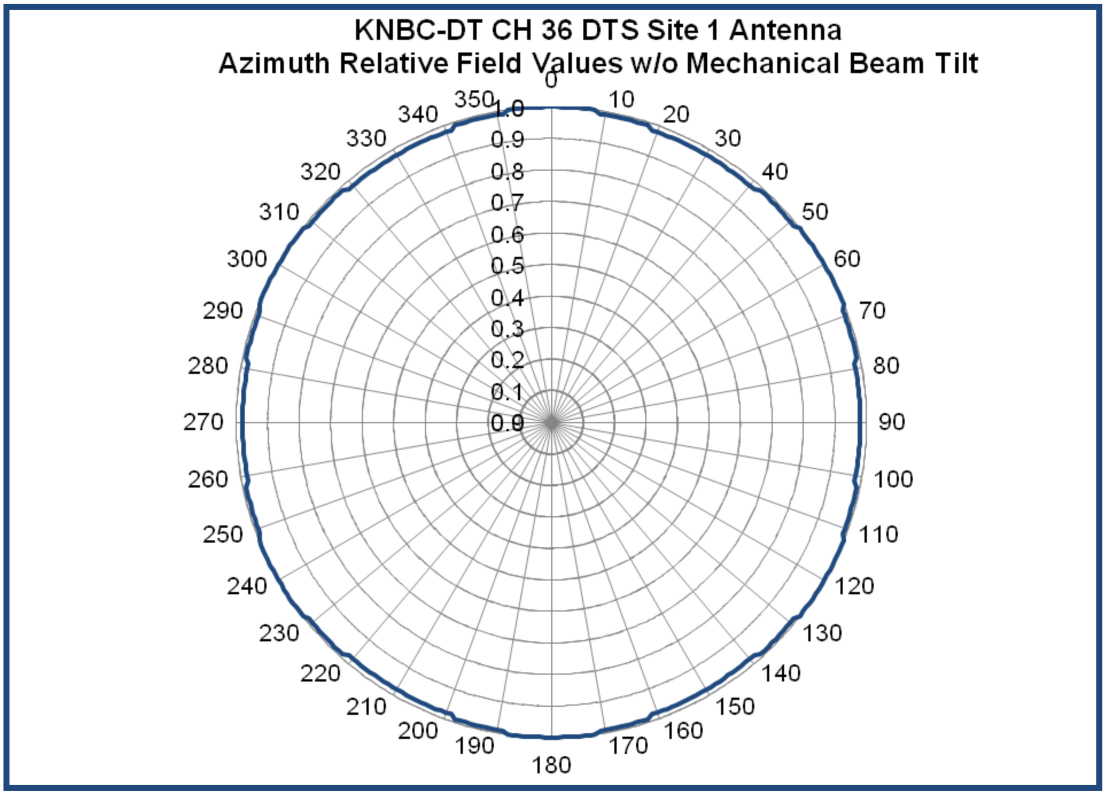

Figure 3 — KNBC Site 1 Azimuth Pattern in Relative Field Values

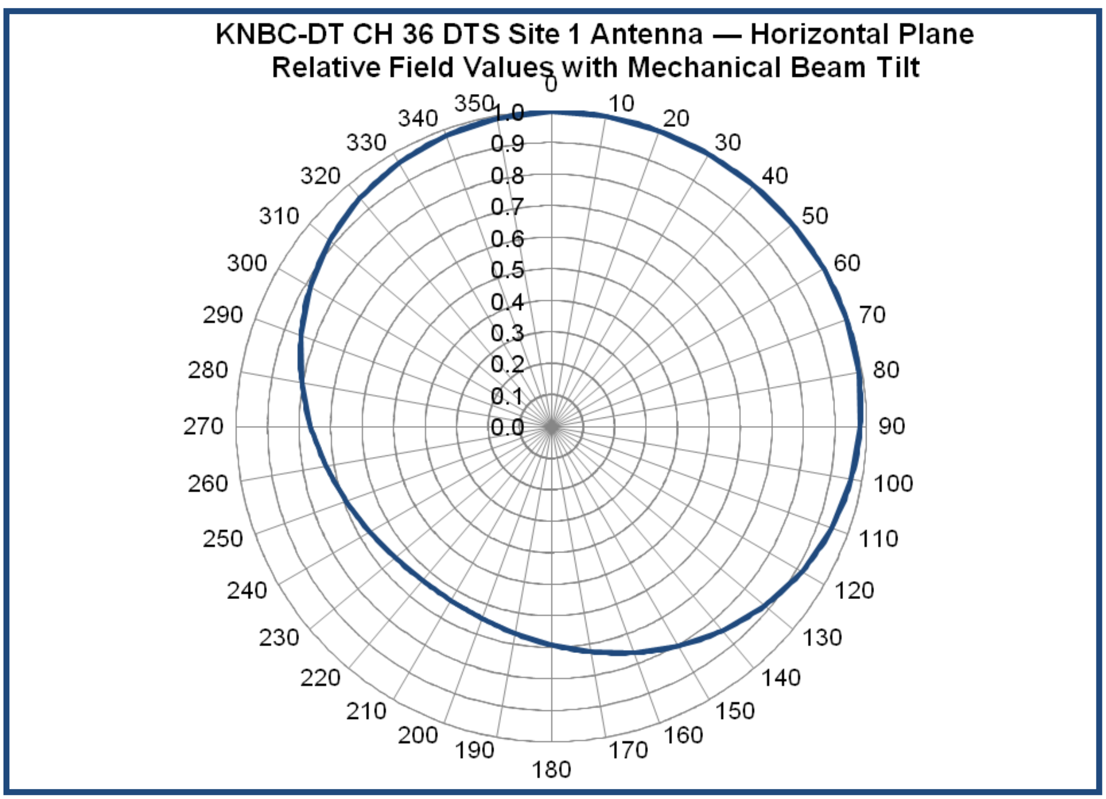

Figure 4 — KNBC Site 1 Horizontal Plane Azimuth Pattern with Effects of Mechanical Beam Tilt Shown

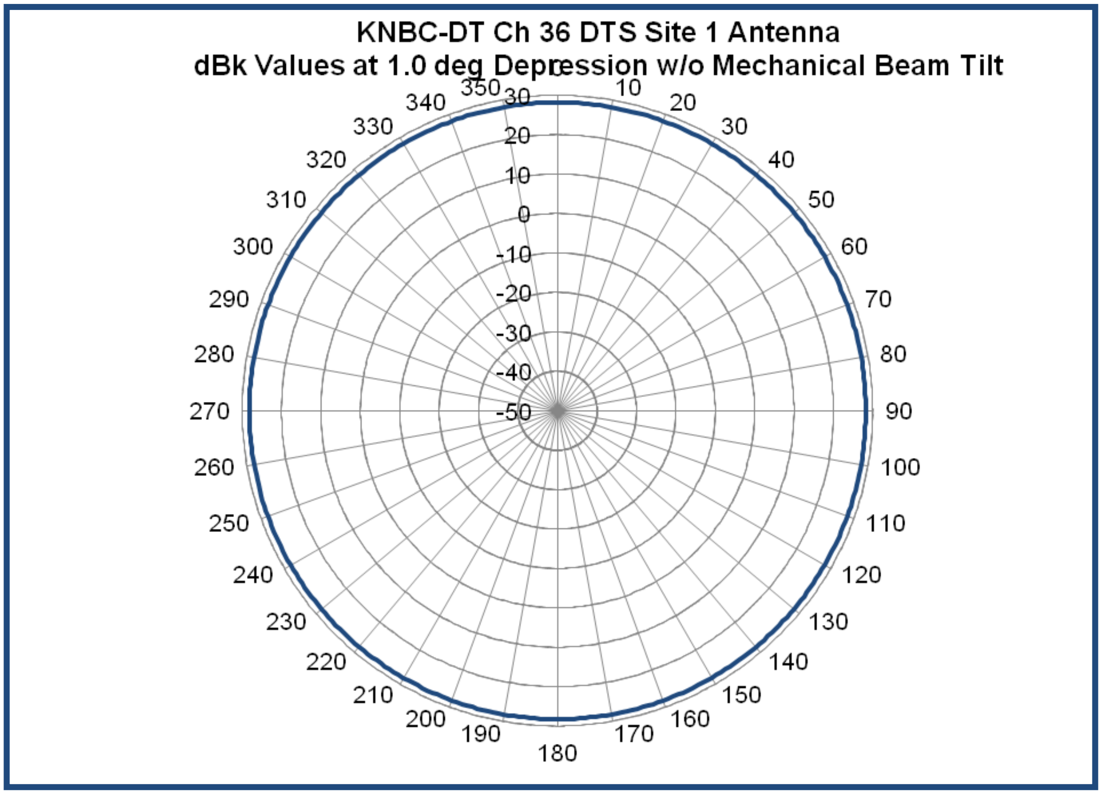

Figure 5 — KNBC Site 1 Azimuthal Radiation Pattern in dBk

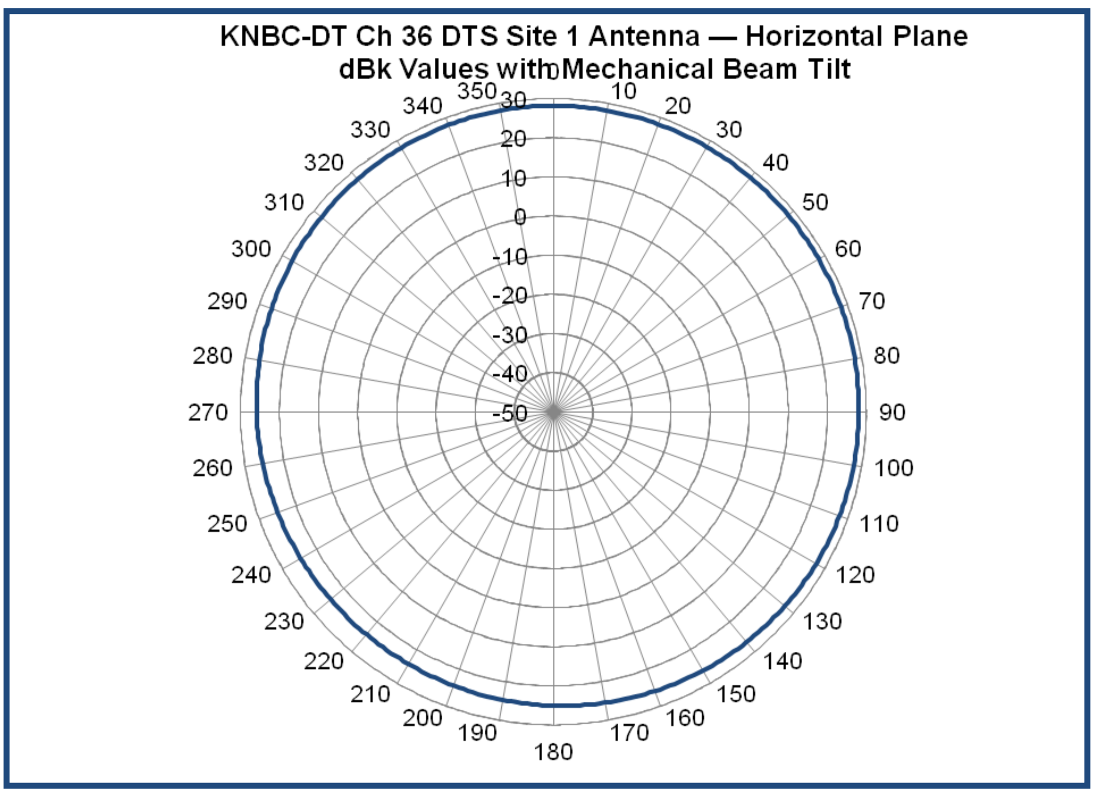

Figure 6 — KNBC Site 1 Horizontal Plane Pattern in dBk with Effects of Mechanical Beam Tilt Shown

Figure 7 — KNBC DTS Site 1 Azimuth Radiation Pattern Tabulated Data

Azimuth	Without Mechanical Beam Tilt		With Mechanical Beam Tilt at Horiz.		Azimuth	Without Mechanical Beam Tilt		With Mechanical Beam Tilt at Horiz.	
	Relative Field	ERP (dBk)	Relative Field	ERP (dBk)		Relative Field	ERP (dBk)	Relative Field	ERP (dBk)
0	1.000	28.228	0.997	28.205	190	0.999	28.220	0.666	24.702
10	0.999	28.220	0.998	28.211	200	0.998	28.211	0.647	24.441
20	0.998	28.211	0.998	28.208	210	0.998	28.211	0.637	24.310
30	0.998	28.211	0.998	28.210	220	0.998	28.211	0.637	24.310
40	0.998	28.211	0.998	28.210	230	0.999	28.220	0.647	24.450
50	0.999	28.220	0.999	28.217	240	1.000	28.228	0.667	24.711
60	1.000	28.228	0.999	28.220	250	0.999	28.220	0.693	25.037
70	0.999	28.220	0.996	28.197	260	0.998	28.211	0.725	25.440
80	0.998	28.211	0.990	28.144	270	0.998	28.211	0.764	25.889
90	0.998	28.211	0.981	28.059	280	0.998	28.211	0.805	26.339
100	0.998	28.211	0.966	27.924	290	0.999	28.220	0.846	26.772
110	0.999	28.220	0.945	27.739	300	1.000	28.228	0.885	27.163
120	1.000	28.228	0.919	27.490	310	0.999	28.220	0.918	27.482
130	0.999	28.220	0.884	27.154	320	0.998	28.211	0.944	27.731
140	0.998	28.211	0.845	26.763	330	0.998	28.211	0.966	27.924
150	0.998	28.211	0.805	26.339	340	0.998	28.211	0.981	28.059
160	0.998	28.211	0.764	25.889	350	0.999	28.220	0.991	28.153
170	0.999	28.220	0.726	25.449					
180	1.000	28.228	0.693	25.046					

Derived from data supplied by manufacturer

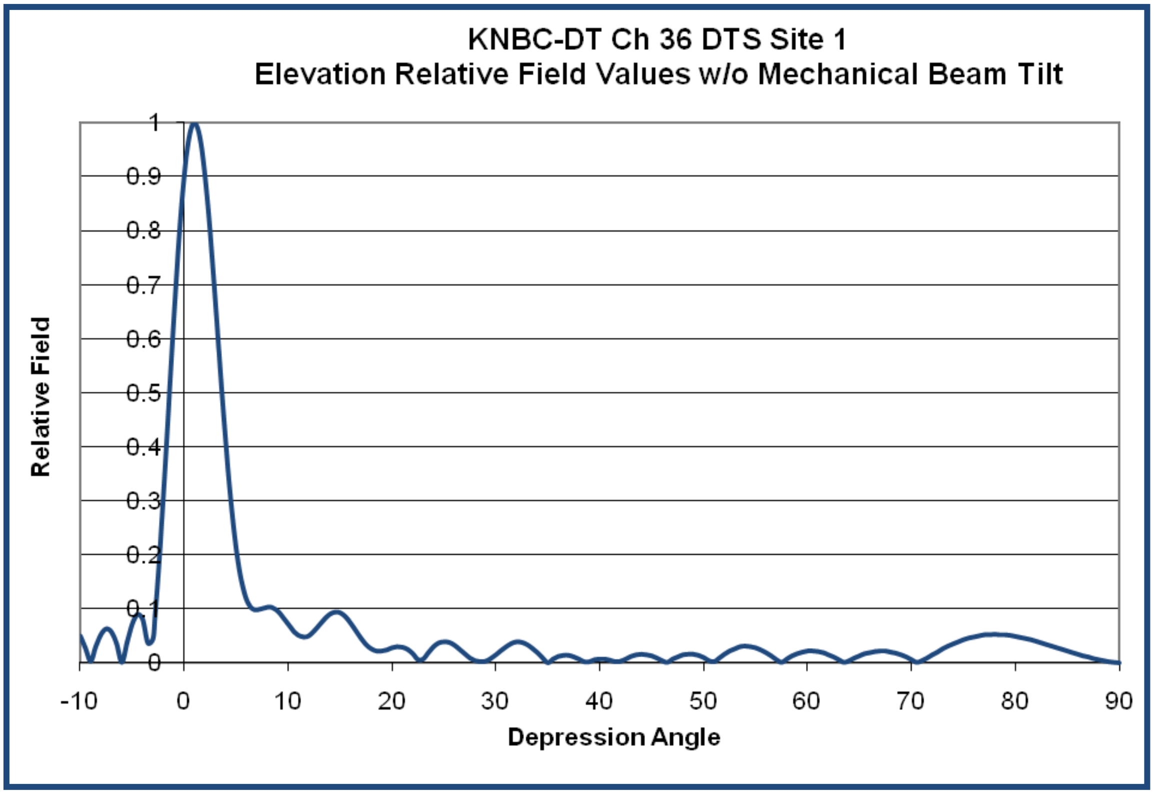

Figure 8 — KNBC Site 1 Elevation Pattern in Relative Field Values

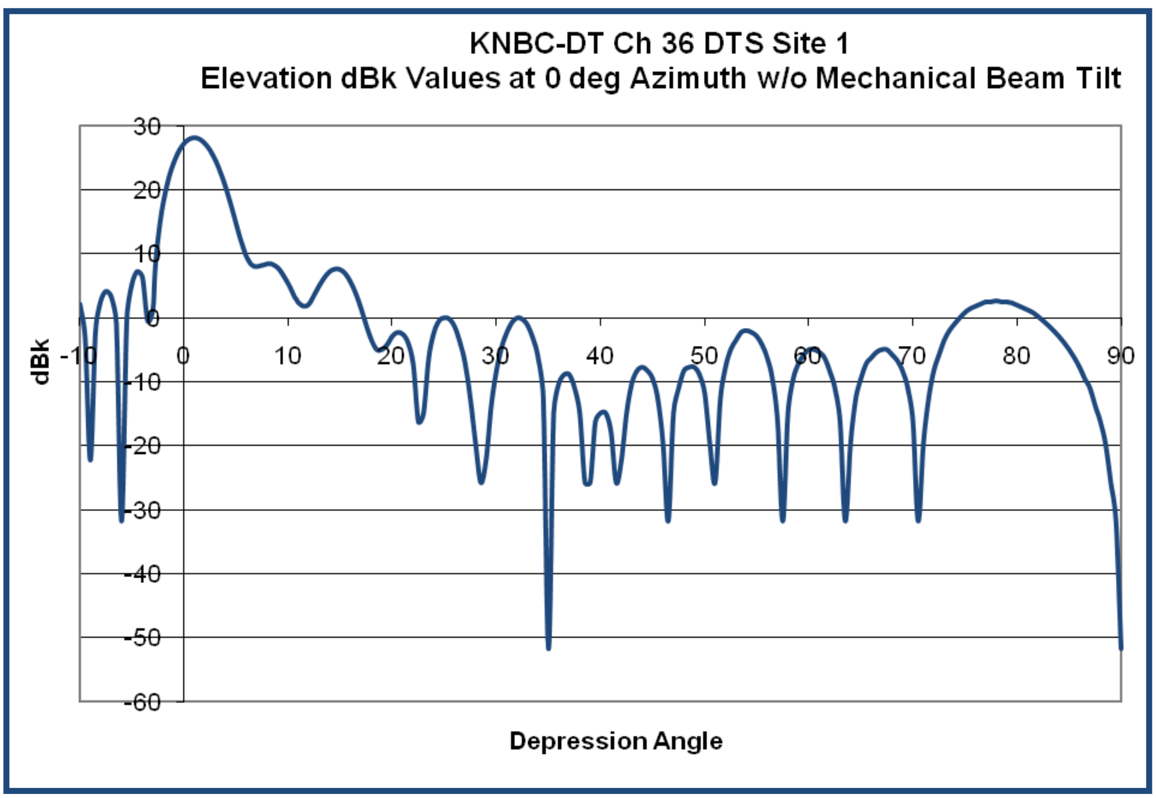

Figure 9 — KNBC Site 1 Elevation Pattern in dBk – without Effects of Mechanical Beam Tilt

Figure 10— KNBC 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	0.072	5.375	9.5	0.085	6.762
-4.5	0.090	7.313	10.0	0.072	5.375
-4.0	0.081	6.398	10.5	0.060	3.711
-3.5	0.037	-0.408	11.0	0.051	2.380
-3.0	0.045	1.292	11.5	0.048	1.853
-2.5	0.164	12.406	12.0	0.050	2.208
-2.0	0.310	18.055	12.5	0.059	3.645
-1.5	0.474	21.713	13.0	0.070	5.130
-1.0	0.637	24.311	13.5	0.081	6.398
-0.5	0.785	26.120	14.0	0.090	7.313
0.0	0.902	27.332	14.5	0.094	7.691
0.5	0.976	28.017	15.0	0.093	7.598
1.0	1.000	28.228	15.5	0.086	6.918
1.5	0.973	27.990	16.0	0.074	5.613
2.0	0.902	27.332	16.5	0.060	3.791
2.5	0.796	26.243	17.0	0.046	1.483
3.0	0.669	24.737	17.5	0.034	-1.142
3.5	0.535	22.784	18.0	0.026	-3.472
4.0	0.408	20.441	18.5	0.022	-4.923
4.5	0.299	17.709	19.0	0.022	-4.923
5.0	0.212	14.755	19.5	0.024	-4.168
5.5	0.153	11.907	20.0	0.028	-2.829
6.0	0.117	9.592	20.5	0.030	-2.229
6.5	0.102	8.357	21.0	0.029	-2.524
7.0	0.098	8.053	21.5	0.025	-3.813
7.5	0.101	8.271	22.0	0.017	-7.163
8.0	0.103	8.485	22.5	0.006	-16.209
8.5	0.102	8.400	23.0	0.007	-14.870
9.0	0.096	7.874	23.5	0.019	-6.197

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 CDBS Electronic Filing System.