

ENGINEERING STATEMENT RE
MODIFICATION OF CONSTRUCTION PERMIT
FCC FILE NO. BPEDT20000501AHQ
ON BEHALF OF
MONTANA STATE UNIVERSITY
KUSM-DT, BOZEMAN, MONTANA
CHANNEL 8 160 KW MAX ERP 271 METERS HAAT

JUNE 2004

COHEN, DIPPELL AND EVERIST, P.C.
CONSULTING ENGINEERS
RADIO AND TELEVISION
WASHINGTON, D.C.

This engineering statement has been prepared on behalf of Montana State University, licensee of KUSM(TV) in support of its request to modify the outstanding construction permit (FCC File No. BPEDT-20000501AHQ) to construct DTV facilities at the Green Mountain electronics site. A rule making request (MM Docket No. 01-163, RM 101341) to change DTV Channel 20* to DTV Channel 8* was submitted to the Commission. MM Docket No. 01-163 was adopted by the Commission. An application was filed (FCC File No. BPEDT 20000501AHQ) and was granted by the Commission. A multi-use antenna is proposed that will accommodate KUSM-DT and KBZK-DT.

Transmitter Site

It is proposed to top-mount the master antenna to an existing guyed tower (see Exhibit E-1). The proposed operation will implement a broadband antenna and accept the input from the proposed DTV Channel 8 and a DTV Channel 13 operation. The coordinates of the tower are as follows:

North Latitude: 45° 40' 24"

West Longitude: 110° 52' 02"

NAD-27

The existing tower with FCC Tower Registration Number 1000681.

Equipment Data

Antenna: Dielectric, Type THA-P2-2H/4HD-1, or equivalent. This is a directional antenna implementing a 'peanut' shaped pattern. All exhibits required by Section 73.625 of the Commission's rules have been included as Exhibits E-2.

Transmission Line: 100 meters (328 feet) of Dielectric, type EIA/DCA 3-1/8" 50 ohm, or equivalent.

Power Data

Transmitter output	16.1 kW	12.07 dBk
Combiner efficiency/loss	95.5 %	0.2 dB
Transmission line efficiency/loss	88.2%	0.545 dB
Antenna Input	13.56 kW	11.33 dBk
Antenna Gain (Max)	11.8	10.73 dB
Maximum Effective Radiated Power (ERP)	160 kW	22.04 dBk

Elevation Data

Vertical dimension of Channel 13 antenna	6.2 meters 20.4 feet
Elevation of site above mean sea level	2015 meters 6611 feet
Overall height above ground of the existing antenna structure including all appurtenances	106.7 meters 350 feet
Overall height above mean sea level of existing antenna structure including all appurtenances	2121.7 meters 6960.9 feet
Center of radiation of DTV Channels 8 and 13 antenna above mean sea level	2110.8 meters 6925.2 feet
Center of radiation of DTV Channels 8 and 13 antenna above ground	95.8 meters 314.3 feet
Antenna height above average terrain	271 meters

NOTE: Slight height differences result due to conversion to metric.

Allocation and Interference Analysis

A DTV allocation study from the proposed site has not been performed for the proposed operation since this request for facilities is less than that ERP authorized by the outstanding construction permit, and therefore, an interference analysis is not required.

Other Licensed and Broadcast Facilities

No adverse technical effect is anticipated by the proposed DTV operation to any other FCC licensed facility. If required, the permittee will install filters or take other measures as necessary to resolve the problem.

Coverage

The average elevation data for 3.2 to 16.1 km along each radial equally spaced at every 10 degrees has been determined based upon 3-second NGDC terrain data. The F(50,90) coverage contours (43 dBu and 36 dBu) have been computed from reference to the propagation data for Channel 7-13 as modeled using specially developed software using Figures 10 and 10a of Section 73.699 of the FCC Rules.

Utilizing the formula in Section 73.625(b)(2) of the Rules for the effective heights, it is found that the depression angle, A_n , varies from [0.077 to 0.674] degrees. The relative field in the vertical plane is greater than 90% for all calculated depression angles and the maximum power was used to determine the distance to the DTV noise limited contour. Table I provides a tabulation at every 10 degrees in azimuth beginning at true north of the effective radiated power in kW and the distance in km to each contour.

A map is included as Exhibit E-3 showing the proposed contour. This map shows the computed coverage contour encompasses the city of license.

Radio Frequency Field Level

This section evaluates the radio frequency field (“RFF”) exposure condition created by the operation of the proposed KUSM-DT operation.

For DTV Channel 8, KUSM-DT and DTV Channel 13, KBZK-DT and operations, will use a Dielectric, Type THA-P2-2H/4HD-1, or equivalent antenna. The antenna manufacturer’s data indicates that the elevation pattern for this antenna has a maximum relative field of approximately 0.1 between 50° and 70° below the horizontal in the vicinity of the tower. The RFF level is calculated using this relative field factor and the procedures prescribed in OET Bulletin No. 65, at an ERP of 160 kW for KUSM-DT DTV Channel 8 and a radiation center of 95.8 meters above ground. The maximum resulting RFF two meters above the base of the tower is computed to be less than 6.1 $\mu\text{W}/\text{cm}^2$. This is less than 0.6% of the maximum allowed controlled exposure and less than 3% of the maximum allowed uncontrolled exposure for the general population.

The KBZK(TV), channel 7 operation, will utilize the same antenna as the proposed KUSM(TV) operation. The maximum ERP for the proposed KBZK(TV) operation will be 43.7 kW, at a radiation center of 102.2 meters above ground. Assuming a relative downward radiation factor of approximately 0.2 towards the ground in the vicinity of the tower for the total of the NTSC operations, the RFF in the vicinity of the base of the tower will be less than 0.3% of the maximum allowed for the controlled exposure and less than 1.5% maximum allowed for uncontrolled exposure to the general population.

It is also proposed to mount another NTSC operation on the tower to transmit NTSC Channel 9. The maximum ERP for the proposed KUSM(TV) operation will be 44 kW, at a radiation center of 102.2 meters above ground. Assuming a relative downward radiation factor of approximately 0.2 towards the ground in the vicinity of the tower for the total of the NTSC

operations, the RFF in the vicinity of the base of the tower will be less than 0.3% of the maximum allowed for the controlled exposure and less than 1.5% maximum allowed for uncontrolled exposure to the general population.

There are no AM towers within 3.2 kilometers of the proposed site. According to the CDBS database dated June 14, 2004, there are three FM stations broadcasting from the KBZK-TV tower, and two television translators within 100 meters. According to the property owner, K32EP in fact, is not located near this site and is not included in the evaluation.

As reported by the station in 1999, the chief engineer of the property owner at that time evaluated the RFF levels two meters above the base of the tower and found the RFF levels to be 25% of the permissible amount. These measurements were performed with KBZK-TV¹, KMMS-FM, KISN-FM, and KYWB-LP operating at full power. This is presumed to be unchanged. In addition, the FCC CDBS database indicates KXLB-FM operates on this tower with an ERP of 94 kW and 82 meters above the ground. The KXLB-FM operation will introduce about another 7% to the RFF amount resulting in a total of 32% of the permissible amount existing around the base of the tower. Also listed in the CDBS, are three construction permits for full service FM facilities, which have not been built, and therefore are not included in the RFF evaluation.

The proposed KBZK-DT, Channel 13 operation, is proposed to transmit through the same antenna as the proposed KUSM-DT at 160 kW creating RFF level two meters above the base of the tower which is computed to be less than $6.1 \mu\text{W}/\text{cm}^2$. This results in less than 0.6% of the limit for controlled exposure and 3% for uncontrolled exposure.

¹For this assessment, the measured value will be used since the antenna radiation center will increase and therefore should result in a reduction of RFF value.

In total, the RFF levels around the base of the tower will not exceed 48% of the maximum allowed for uncontrolled exposure with all facilities within 100 meters of the tower operating at full power.

Authorized personnel and rigging contractors will be alerted to the potential zone of high radiation on the tower, and if necessary, the station will operate with reduced power or terminate the operation of the transmitter as appropriate when it is necessary for authorized personnel or contractors to perform work on the tower. Workers and the general public therefore, will not be subjected to RFF levels in excess of the current FCC guidelines.

FCC Rule, Section 1.1307

The proposed operation based upon the current OET Bulletin No. 65, Edition 97-01, dated August 1997 and Supplement A meets the provisions of the FCC radio frequency field guidelines, and thus, complies with Section 1.1307 of the FCC Rules.

An environmental assessment ("EA") is categorically excluded under Section 1.1306 of the FCC Rules and Regulations since the permittee:

- (a)(1) The existing site is not located in an officially designated wilderness area.
- (a)(2) The existing site is not located in an officially designated wildlife preserve.
- (a)(3) The proposed facilities will not affect any listed threatened or endangered species or habitats.
- (a)(3)(ii) The proposed facilities will not jeopardize the continued existence of any proposed endangered or threatened species or likely to result in the destruction or adverse modification of proposed critical habitats.
- (a)(4) The proposed facilities will not affect any known districts, sites, buildings, structures, or objects significant in American history, architecture, archaeology, engineering or culture.

- (a)(5) The existing site is not located near any known Indian religious sites.
- (a)(6) The existing site is not located in a flood plain.
- (a)(7) The installation of the new panel antenna on the modified tower will not involve a significant change in surface features of the ground in the vicinity of the tower.
- (a)(8) It is not proposed to change the current lighting on the tower.
- (b) Workers and the general public will not be subjected to RFF levels in excess of the current FCC guidelines in accordance with OET Bulletin No. 65, Edition 97-01, dated August 1997 and Supplement A. Authorized personnel will be alerted to areas of the antennas where potential radiation is in excess of the FCC guidelines. A locked gate at the entrance road deters unauthorized access to the tower site.

Cohen, Dippell and Everist, P.C.

TABLE I
COMPUTED COVERAGE DATA
FOR THE PROPOSED DTV OPERATION OF
KUSM-DT, BOZEMAN, MONTANA
CHANNEL 8 160 KW ERP (MAX DA) 271 METERS HAAT
JUNE 2004

<u>Radial</u> <u>Bearing</u> N ° E, T	<u>Average*</u> <u>Elevation</u> <u>3.2-16.1 km</u> meters	<u>Effective</u> <u>Height</u> meters	<u>ERP</u> kW	<u>Distance to Contour F(50,90)</u>	
				<u>43 dBu</u> <u>City Grade</u> km	<u>36 dBu</u> <u>Noise-Limited</u> km
0	1828.0	282.8	0.243	51.5	62.9
10	1954.8	155.9	0.595	49.8	61.0
20	2063.7	47.4	2.621	40.8	51.4
30	2100.9	10.5	3.994	29.6	38.1
40	2067.9	43.5	21.316	52.7	63.6
50	2003.5	107.2	54.756	75.3	86.9
60	1955.0	156.0	90.721	86.9	98.3
70	1901.9	209.7	123.061	94.0	106.8
80	1818.8	292.1	148.071	100.3	114.6
90	1709.5	404.9	160.000	109.8	125.7
100	1658.7	451.8	148.071	113.2	129.8
110	1733.1	377.6	123.061	105.4	120.1
120	1914.1	196.9	90.721	90.6	102.8
130	1983.3	127.1	54.756	79.3	91.1
140	2047.6	63.2	21.316	59.2	70.0
150	1847.3	263.7	3.994	70.9	83.6
160	1859.6	250.9	2.621	66.9	79.7
170	1910.3	200.1	0.595	53.1	64.7
180	2021.6	88.8	0.243	34.7	45.5
190	2025.8	84.7	0.595	40.0	50.7
200	2033.2	76.9	2.621	48.3	59.1
210	1901.4	208.5	3.994	67.5	80.3
220	1859.9	250.6	21.316	83.5	96.0
230	1749.6	361.2	54.756	97.6	111.0

Cohen, Dippell and Everist, P.C.

TABLE I
COMPUTED COVERAGE DATA
FOR THE PROPOSED DTV OPERATION OF
KUSM-DT, BOZEMAN, MONTANA
CHANNEL 8 160 KW ERP (MAX DA) 271 METERS HAAT
JUNE 2004
 (continued)

<u>Radial</u> <u>Bearing</u> N ° E, T	<u>Average*</u> <u>Elevation</u> <u>3.2-16.1 km</u> meters	<u>Effective</u> <u>Height</u> meters	<u>ERP</u> kW	<u>Distance to Contour F(50,90)</u>	
				<u>43 dBu</u> <u>City Grade</u> km	<u>36 dBu</u> <u>Noise-Limited</u> km
240	1628.9	481.7	90.721	111.0	126.6
250	1576.7	533.9	123.061	116.4	134.4
260	1555.7	554.8	148.071	119.4	138.7
270	1516.2	594.4	160.000	123.0	142.2
280	1531.9	579.3	148.071	121.1	140.4
290	1553.3	557.5	123.061	117.8	136.4
300	1583.4	527.4	90.721	113.4	130.0
310	1736.3	374.4	54.756	98.5	112.1
320	1895.1	215.7	21.316	81.3	93.4
330	1977.1	133.5	3.994	60.3	72.5
340	1953.9	157.4	2.621	60.3	72.6
350	1783.8	327.0	0.595	60.5	72.6
Average	1840.0				

*Based on data from FCC 3-second data base

DTV Channel 8 (180-186 MHz)
 Average Elevation 3.2 to 16.1 km 1840 meters AMSL
 Center of Radiation 2110.8 meters AMSL
 Antenna Height Above Average Terrain 271 meters
 Effective Radiated Power 160 kW (22.04 dBk) Max.

North Latitude: 45° 40' 24"
 West Longitude: 110° 52' 02"
 (NAD-27)

ABOVE GROUND

ABOVE MEAN SEA LEVEL

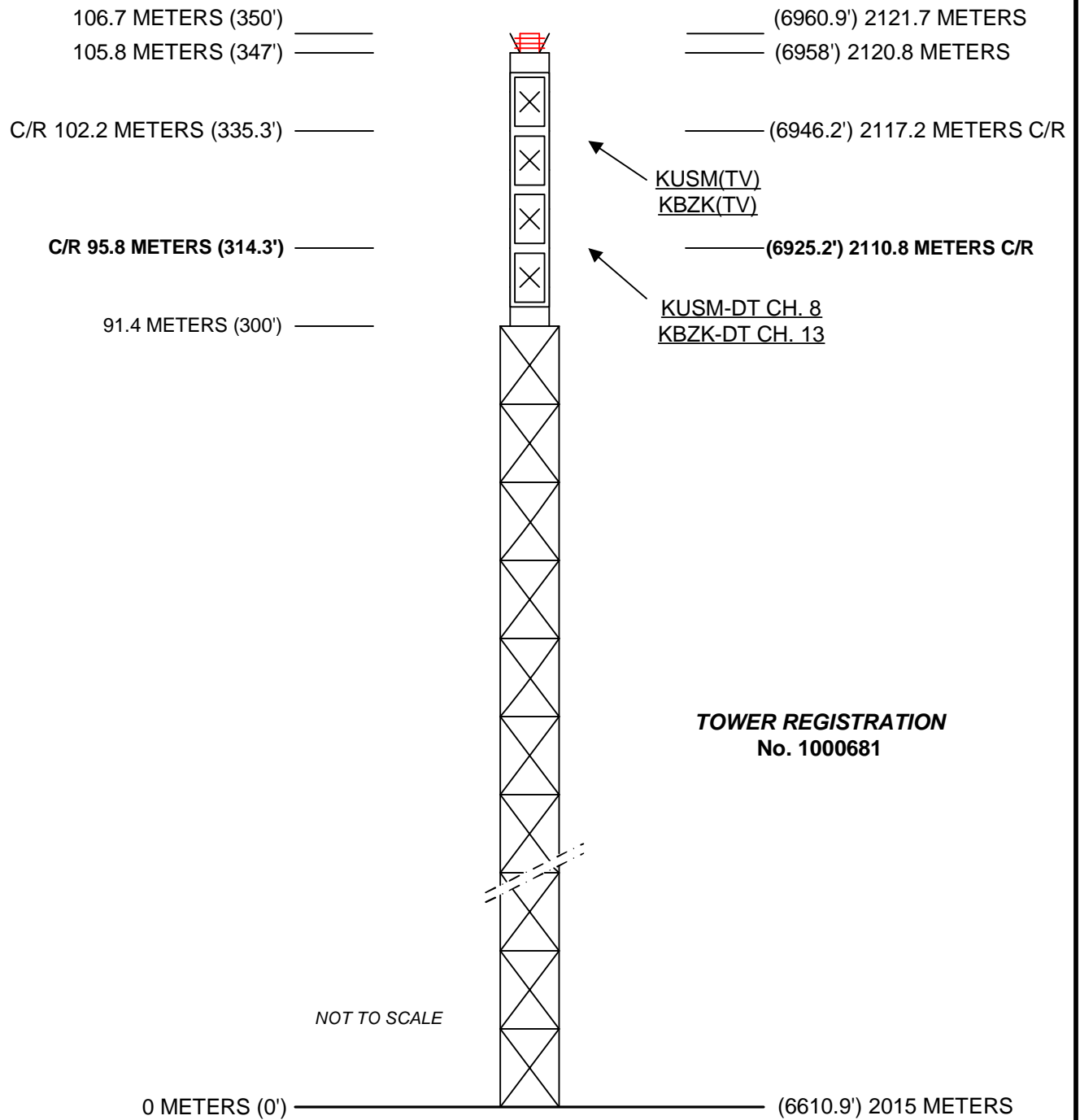


EXHIBIT E - 1
VERTICAL SKETCH
FOR THE PROPOSED OPERATION OF
KUSM-DT, BOZEMAN, MONTANA
JUNE 2004

Cohen, Dippell and Everist, P.C.

EXHIBIT E-2

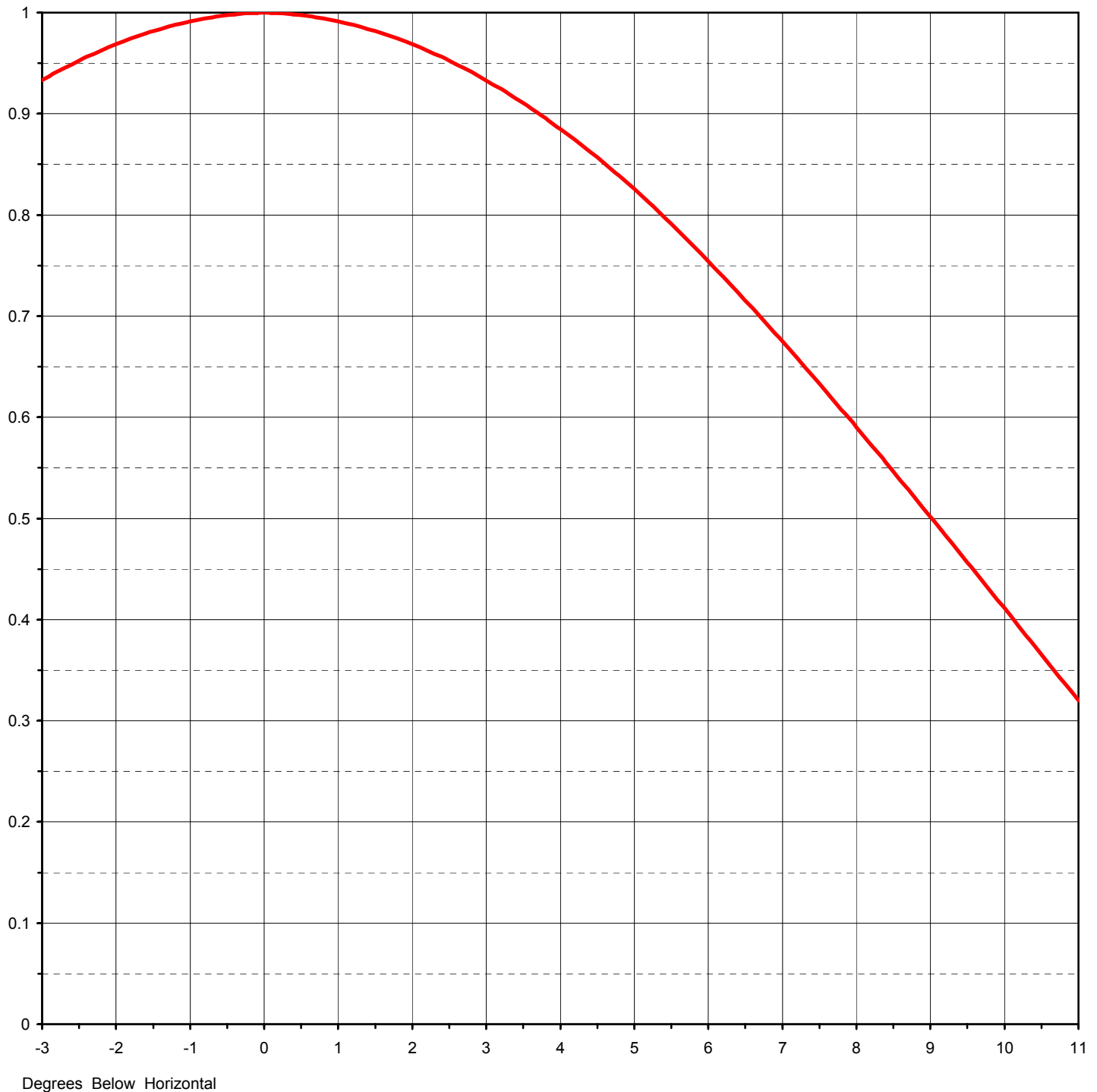
ANTENNA MANUFACTURER DATA



Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ	Channel	8
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

ELEVATION PATTERN

RMS Gain at Main Lobe	4.30 (6.33 dB)	Beam Tilt	0.00 deg
RMS Gain at Horizontal	4.30 (6.33 dB)	Frequency	183.00 MHz
Calculated / Measured	Calculated	Drawing #	02H043000



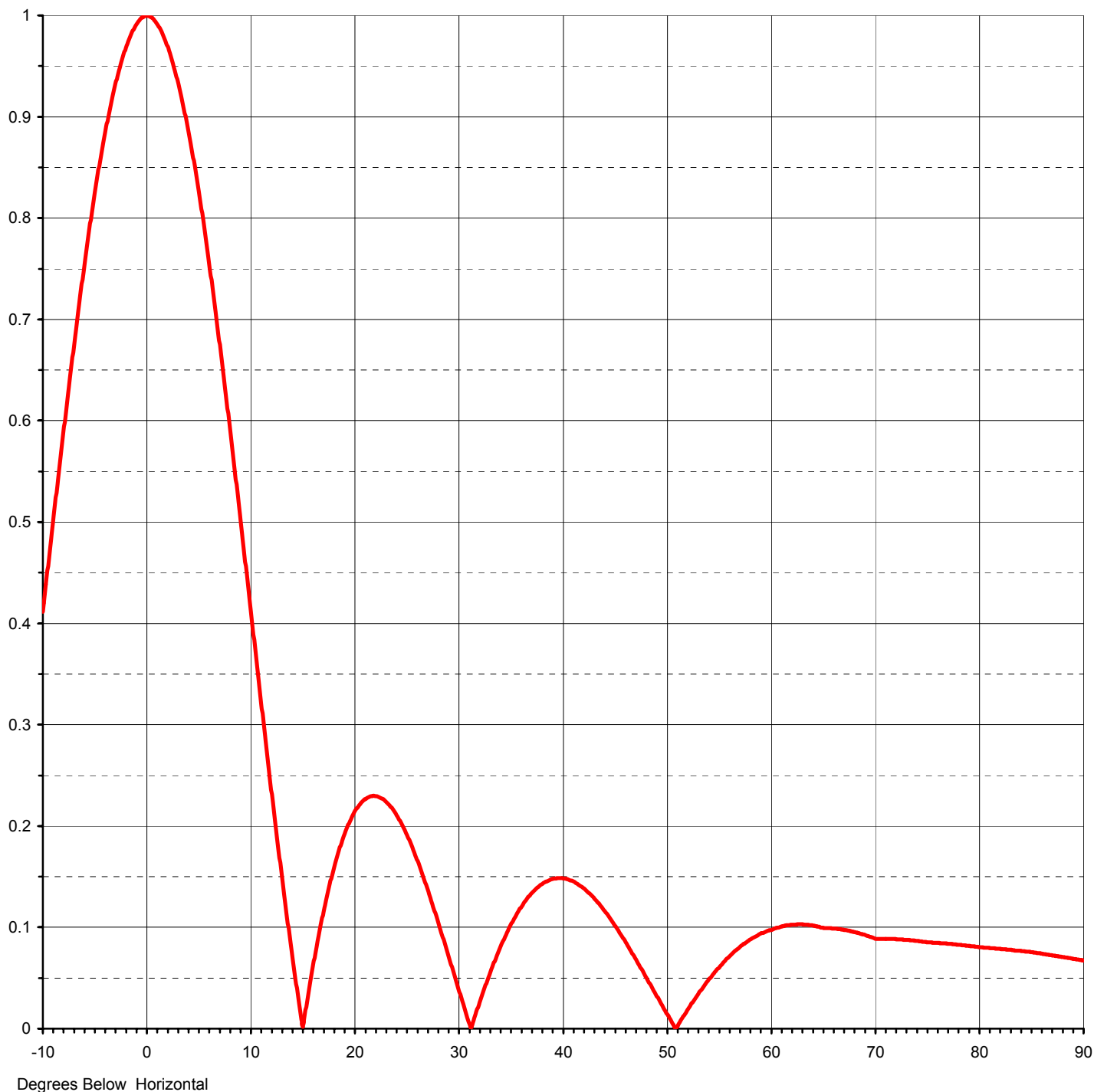


Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ	Channel	8
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

ELEVATION PATTERN

RMS Gain at Main Lobe	4.30	(6.33 dB)
RMS Gain at Horizontal	4.30	(6.33 dB)
Calculated / Measured	Calculated	

Beam Tilt	0.00 deg
Frequency	183.00 MHz
Drawing #	02H043000-90





Proposal Number **DCA-9073** Revision: **2**
 Date **15-Jan-01**
 Call Letters **KCTZ** Channel **8**
 Location **Bozeman, MT**
 Customer **Cordillera**
 Antenna Type **THA-P2-2H/4HD-1**

TABULATION OF ELEVATION PATTERN

Elevation Pattern Drawing #: **02H043000-90**

Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.411	2.4	0.956	10.6	0.366	30.5	0.024	51.0	0.001	71.5	0.089
-9.5	0.457	2.6	0.949	10.8	0.347	31.0	0.008	51.5	0.010	72.0	0.088
-9.0	0.502	2.8	0.941	11.0	0.329	31.5	0.008	52.0	0.018	72.5	0.088
-8.5	0.546	3.0	0.933	11.5	0.284	32.0	0.024	52.5	0.026	73.0	0.088
-8.0	0.590	3.2	0.924	12.0	0.240	32.5	0.039	53.0	0.033	73.5	0.087
-7.5	0.633	3.4	0.915	12.5	0.197	33.0	0.053	53.5	0.040	74.0	0.086
-7.0	0.675	3.6	0.906	13.0	0.156	33.5	0.066	54.0	0.047	74.5	0.086
-6.5	0.715	3.8	0.896	13.5	0.115	34.0	0.079	54.5	0.054	75.0	0.085
-6.0	0.754	4.0	0.885	14.0	0.077	34.5	0.090	55.0	0.060	75.5	0.085
-5.5	0.791	4.2	0.874	14.5	0.040	35.0	0.101	55.5	0.065	76.0	0.085
-5.0	0.826	4.4	0.863	15.0	0.005	35.5	0.111	56.0	0.071	76.5	0.084
-4.5	0.857	4.6	0.851	15.5	0.028	36.0	0.119	56.5	0.075	77.0	0.084
-4.0	0.885	4.8	0.839	16.0	0.058	36.5	0.126	57.0	0.080	77.5	0.083
-3.5	0.910	5.0	0.826	16.5	0.086	37.0	0.133	57.5	0.084	78.0	0.083
-3.0	0.933	5.2	0.812	17.0	0.112	37.5	0.138	58.0	0.087	78.5	0.082
-2.8	0.941	5.4	0.798	17.5	0.135	38.0	0.142	58.5	0.091	79.0	0.082
-2.6	0.949	5.6	0.784	18.0	0.156	38.5	0.145	59.0	0.093	79.5	0.081
-2.4	0.956	5.8	0.769	18.5	0.174	39.0	0.147	59.5	0.095	80.0	0.080
-2.2	0.963	6.0	0.754	19.0	0.190	39.5	0.148	60.0	0.097	80.5	0.080
-2.0	0.969	6.2	0.739	19.5	0.202	40.0	0.148	60.5	0.099	81.0	0.080
-1.8	0.974	6.4	0.723	20.0	0.213	40.5	0.147	61.0	0.101	81.5	0.079
-1.6	0.979	6.6	0.707	20.5	0.221	41.0	0.146	61.5	0.102	82.0	0.079
-1.4	0.984	6.8	0.691	21.0	0.226	41.5	0.143	62.0	0.102	82.5	0.078
-1.2	0.988	7.0	0.675	21.5	0.229	42.0	0.139	62.5	0.103	83.0	0.078
-1.0	0.991	7.2	0.659	22.0	0.230	42.5	0.135	63.0	0.103	83.5	0.077
-0.8	0.994	7.4	0.642	22.5	0.228	43.0	0.130	63.5	0.103	84.0	0.077
-0.6	0.997	7.6	0.625	23.0	0.225	43.5	0.124	64.0	0.102	84.5	0.076
-0.4	0.998	7.8	0.608	23.5	0.219	44.0	0.117	64.5	0.101	85.0	0.075
-0.2	0.999	8.0	0.590	24.0	0.212	44.5	0.110	65.0	0.099	85.5	0.075
0.0	1.000	8.2	0.573	24.5	0.204	45.0	0.103	65.5	0.099	86.0	0.074
0.2	0.999	8.4	0.555	25.0	0.193	45.5	0.095	66.0	0.099	86.5	0.073
0.4	0.998	8.6	0.537	25.5	0.181	46.0	0.087	66.5	0.098	87.0	0.072
0.6	0.997	8.8	0.520	26.0	0.168	46.5	0.079	67.0	0.097	87.5	0.072
0.8	0.994	9.0	0.502	26.5	0.154	47.0	0.070	67.5	0.097	88.0	0.071
1.0	0.991	9.2	0.484	27.0	0.140	47.5	0.061	68.0	0.095	88.5	0.070
1.2	0.988	9.4	0.466	27.5	0.124	48.0	0.052	68.5	0.094	89.0	0.069
1.4	0.984	9.6	0.447	28.0	0.108	48.5	0.043	69.0	0.092	89.5	0.068
1.6	0.979	9.8	0.438	28.5	0.091	49.0	0.034	69.5	0.091	90.0	0.067
1.8	0.974	10.0	0.420	29.0	0.074	49.5	0.025	70.0	0.089		
2.0	0.969	10.2	0.402	29.5	0.058	50.0	0.016	70.5	0.089		
2.2	0.963	10.4	0.384	30.0	0.041	50.5	0.007	71.0	0.089		

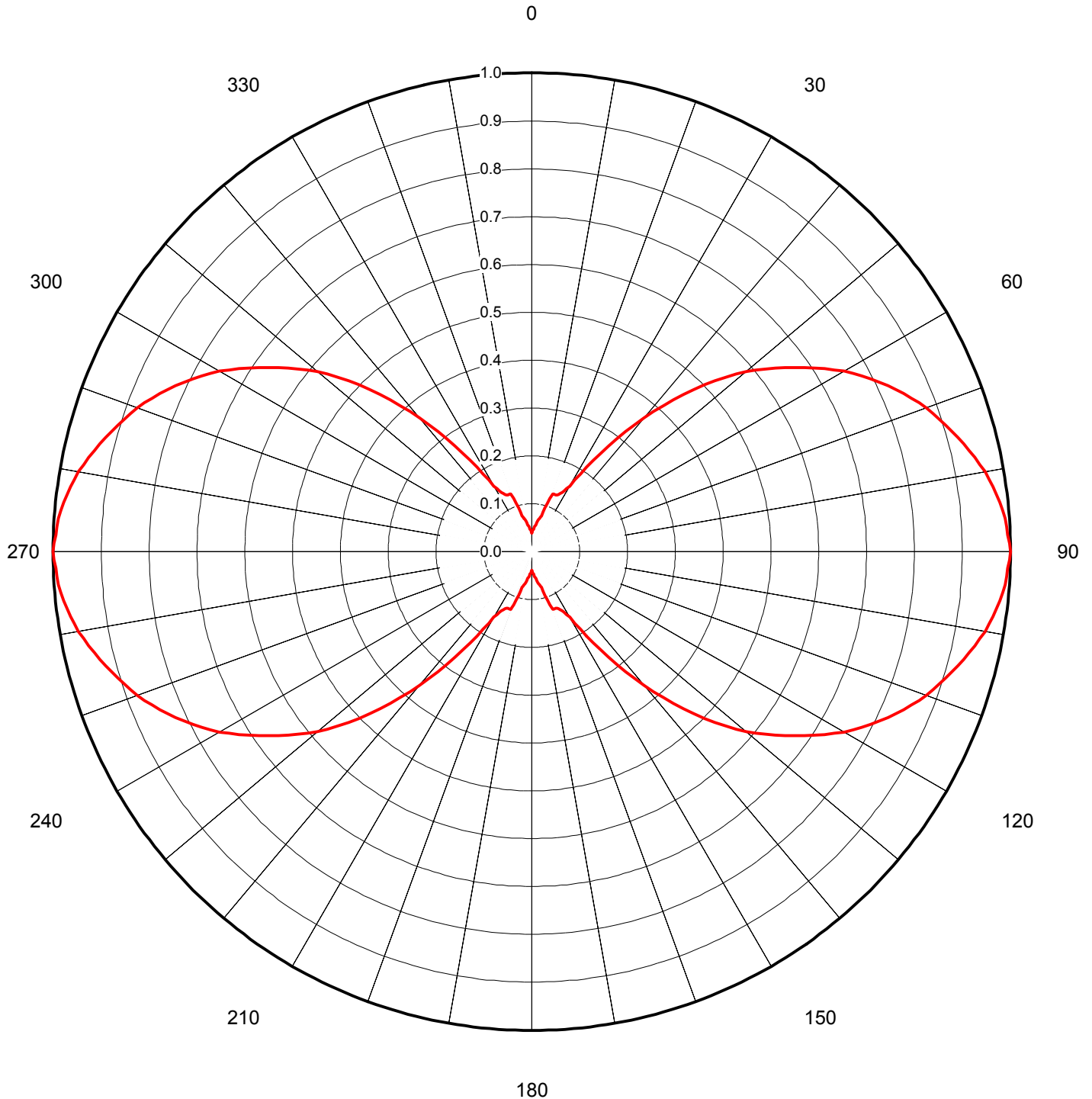


Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ	Channel	8
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

AZIMUTH PATTERN

Gain **2.75** **(4.40 dB)**
Calculated / Measured **Calculated**

Frequency **183.00 MHz**
Drawing # **THA-P4-8**





Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ	Channel	8
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

TABULATION OF AZIMUTH PATTERN

Azimuth Pattern Drawing #: **THA-P4-8**

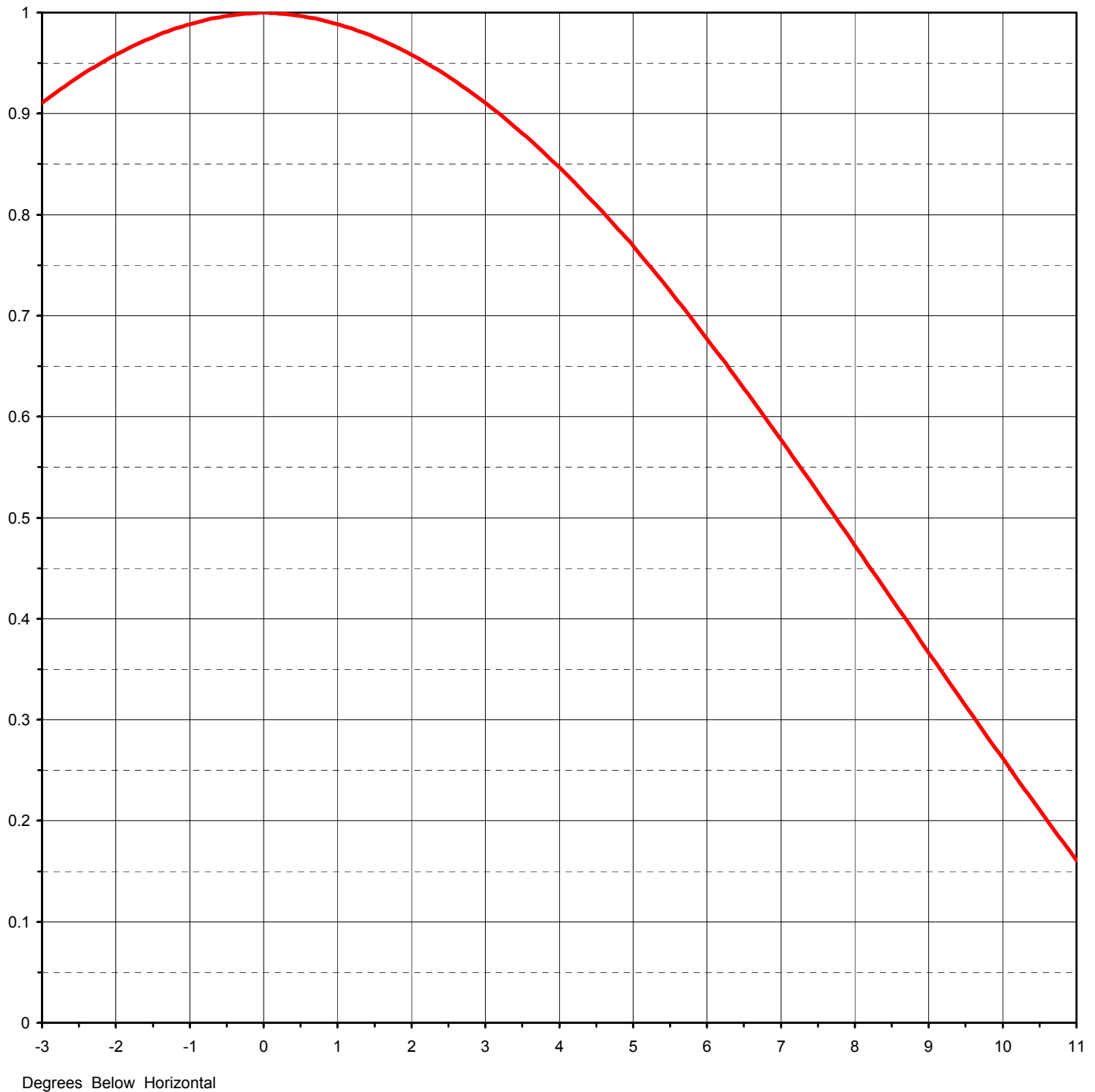
Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
0	0.039	45	0.478	90	1.000	135	0.478	180	0.039	225	0.478	270	1.000	315	0.478
1	0.041	46	0.501	91	0.998	136	0.456	181	0.041	226	0.501	271	0.998	316	0.456
2	0.043	47	0.523	92	0.995	137	0.433	182	0.043	227	0.523	272	0.995	317	0.433
3	0.045	48	0.544	93	0.993	138	0.410	183	0.045	228	0.544	273	0.993	318	0.410
4	0.046	49	0.565	94	0.991	139	0.388	184	0.046	229	0.565	274	0.991	319	0.388
5	0.047	50	0.585	95	0.988	140	0.365	185	0.047	230	0.585	275	0.988	320	0.365
6	0.051	51	0.603	96	0.983	141	0.342	186	0.051	231	0.603	276	0.983	321	0.342
7	0.053	52	0.620	97	0.978	142	0.318	187	0.053	232	0.620	277	0.978	322	0.318
8	0.056	53	0.637	98	0.972	143	0.295	188	0.056	233	0.637	278	0.972	323	0.295
9	0.059	54	0.653	99	0.967	144	0.272	189	0.059	234	0.653	279	0.967	324	0.272
10	0.061	55	0.670	100	0.962	145	0.249	190	0.061	235	0.670	280	0.962	325	0.249
11	0.065	56	0.687	101	0.954	146	0.229	191	0.065	236	0.687	281	0.954	326	0.229
12	0.068	57	0.705	102	0.946	147	0.210	192	0.068	237	0.705	282	0.946	327	0.210
13	0.072	58	0.721	103	0.938	148	0.192	193	0.072	238	0.721	283	0.938	328	0.192
14	0.075	59	0.738	104	0.929	149	0.174	194	0.075	239	0.738	284	0.929	329	0.174
15	0.077	60	0.753	105	0.922	150	0.158	195	0.077	240	0.753	285	0.922	330	0.158
16	0.086	61	0.767	106	0.913	151	0.150	196	0.086	241	0.767	286	0.913	331	0.150
17	0.096	62	0.781	107	0.904	152	0.144	197	0.096	242	0.781	287	0.904	332	0.144
18	0.106	63	0.794	108	0.895	153	0.138	198	0.106	243	0.794	288	0.895	333	0.138
19	0.117	64	0.808	109	0.886	154	0.134	199	0.117	244	0.808	289	0.886	334	0.134
20	0.128	65	0.821	110	0.877	155	0.131	200	0.128	245	0.821	290	0.877	335	0.131
21	0.128	66	0.832	111	0.866	156	0.130	201	0.128	246	0.832	291	0.866	336	0.130
22	0.128	67	0.844	112	0.855	157	0.129	202	0.128	247	0.844	292	0.855	337	0.129
23	0.129	68	0.855	113	0.844	158	0.128	203	0.129	248	0.855	293	0.844	338	0.128
24	0.130	69	0.866	114	0.832	159	0.128	204	0.130	249	0.866	294	0.832	339	0.128
25	0.131	70	0.877	115	0.821	160	0.128	205	0.131	250	0.877	295	0.821	340	0.128
26	0.134	71	0.886	116	0.808	161	0.117	206	0.134	251	0.886	296	0.808	341	0.117
27	0.138	72	0.895	117	0.794	162	0.106	207	0.138	252	0.895	297	0.794	342	0.106
28	0.144	73	0.904	118	0.781	163	0.096	208	0.144	253	0.904	298	0.781	343	0.096
29	0.150	74	0.913	119	0.767	164	0.086	209	0.150	254	0.913	299	0.767	344	0.086
30	0.158	75	0.922	120	0.753	165	0.077	210	0.158	255	0.922	300	0.753	345	0.077
31	0.174	76	0.929	121	0.738	166	0.075	211	0.174	256	0.929	301	0.738	346	0.075
32	0.192	77	0.938	122	0.721	167	0.072	212	0.192	257	0.938	302	0.721	347	0.072
33	0.210	78	0.946	123	0.705	168	0.068	213	0.210	258	0.946	303	0.705	348	0.068
34	0.229	79	0.954	124	0.687	169	0.065	214	0.229	259	0.954	304	0.687	349	0.065
35	0.249	80	0.962	125	0.670	170	0.061	215	0.249	260	0.962	305	0.670	350	0.061
36	0.272	81	0.967	126	0.653	171	0.059	216	0.272	261	0.967	306	0.653	351	0.059
37	0.295	82	0.972	127	0.637	172	0.056	217	0.295	262	0.972	307	0.637	352	0.056
38	0.318	83	0.978	128	0.620	173	0.053	218	0.318	263	0.978	308	0.620	353	0.053
39	0.342	84	0.983	129	0.603	174	0.051	219	0.342	264	0.983	309	0.603	354	0.051
40	0.365	85	0.988	130	0.585	175	0.047	220	0.365	265	0.988	310	0.585	355	0.047
41	0.388	86	0.991	131	0.565	176	0.046	221	0.388	266	0.991	311	0.565	356	0.046
42	0.410	87	0.993	132	0.544	177	0.045	222	0.410	267	0.993	312	0.544	357	0.045
43	0.433	88	0.995	133	0.523	178	0.043	223	0.433	268	0.995	313	0.523	358	0.043
44	0.456	89	0.998	134	0.501	179	0.041	224	0.456	269	0.998	314	0.501	359	0.041



Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ-DT	Channel	13
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

ELEVATION PATTERN

RMS Gain at Main Lobe	4.80 (6.81 dB)	Beam Tilt	0.00 deg
RMS Gain at Horizontal	4.80 (6.81 dB)	Frequency	213.00 MHz
Calculated / Measured	Calculated	Drawing #	02H048000



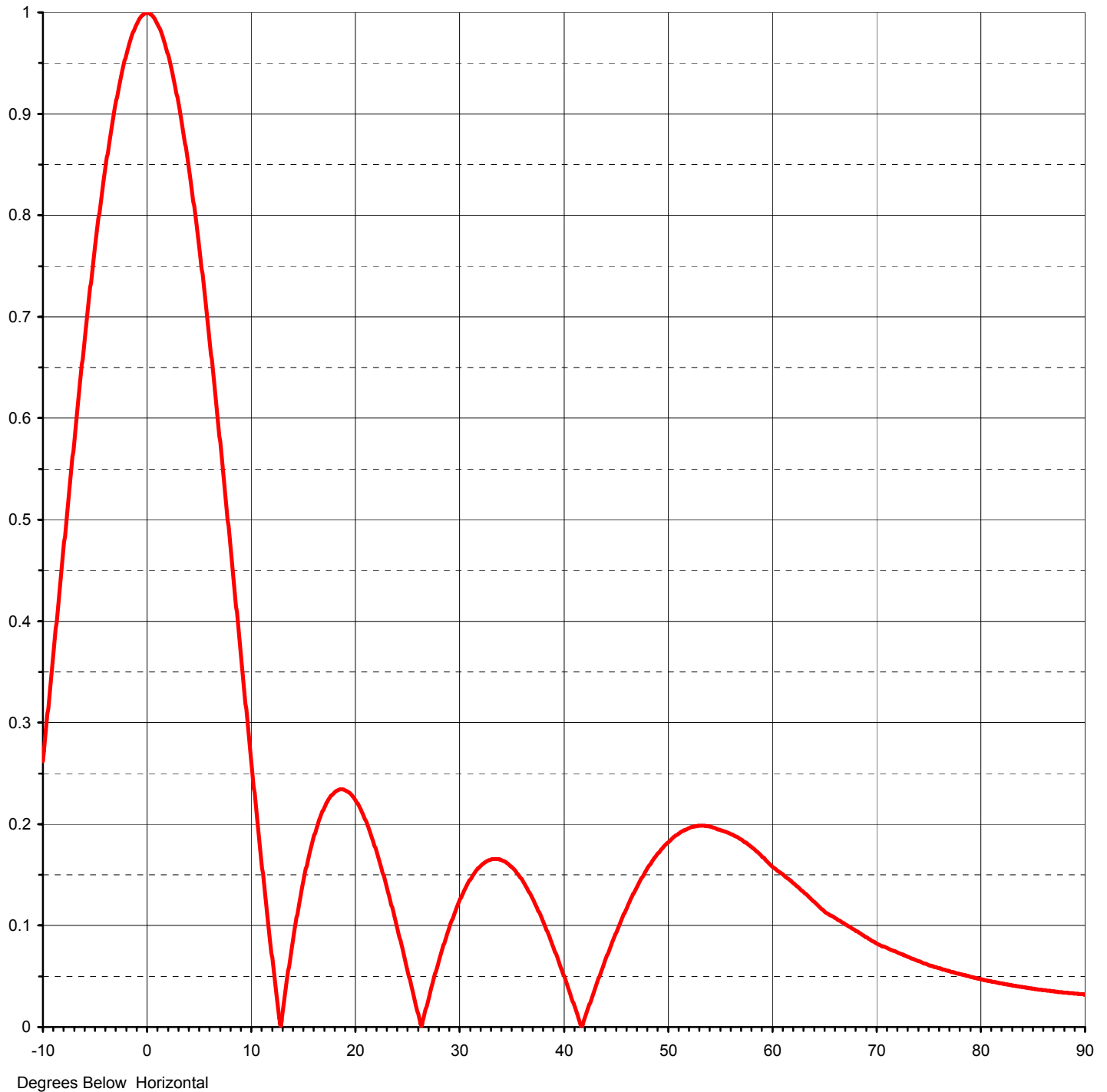


Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ-DT	Channel	13
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

ELEVATION PATTERN

RMS Gain at Main Lobe	4.80	(6.81 dB)
RMS Gain at Horizontal	4.80	(6.81 dB)
Calculated / Measured	Calculated	

Beam Tilt	0.00 deg
Frequency	213.00 MHz
Drawing #	02H048000-90





Proposal Number **DCA-9073** Revision: **2**
 Date **15-Jan-01**
 Call Letters **KCTZ-DT** Channel **13**
 Location **Bozeman, MT**
 Customer **Cordillera**
 Antenna Type **THA-P2-2H/4HD-1**

TABULATION OF ELEVATION PATTERN

Elevation Pattern Drawing #: **02H048000-90**

Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.262	2.4	0.941	10.6	0.211	30.5	0.134	51.0	0.190	71.5	0.076
-9.5	0.314	2.6	0.932	10.8	0.191	31.0	0.144	51.5	0.193	72.0	0.073
-9.0	0.366	2.8	0.921	11.0	0.171	31.5	0.152	52.0	0.196	72.5	0.071
-8.5	0.420	3.0	0.910	11.5	0.123	32.0	0.158	52.5	0.197	73.0	0.069
-8.0	0.473	3.2	0.899	12.0	0.077	32.5	0.162	53.0	0.198	73.5	0.067
-7.5	0.525	3.4	0.887	12.5	0.034	33.0	0.165	53.5	0.198	74.0	0.065
-7.0	0.577	3.6	0.874	13.0	0.007	33.5	0.166	54.0	0.198	74.5	0.063
-6.5	0.628	3.8	0.861	13.5	0.045	34.0	0.165	54.5	0.196	75.0	0.061
-6.0	0.677	4.0	0.847	14.0	0.079	34.5	0.162	55.0	0.194	75.5	0.060
-5.5	0.724	4.2	0.832	14.5	0.111	35.0	0.159	55.5	0.193	76.0	0.058
-5.0	0.769	4.4	0.817	15.0	0.139	35.5	0.153	56.0	0.191	76.5	0.056
-4.5	0.809	4.6	0.802	15.5	0.163	36.0	0.146	56.5	0.188	77.0	0.055
-4.0	0.847	4.8	0.786	16.0	0.184	36.5	0.138	57.0	0.185	77.5	0.054
-3.5	0.881	5.0	0.769	16.5	0.201	37.0	0.128	57.5	0.182	78.0	0.052
-3.0	0.911	5.2	0.751	17.0	0.214	37.5	0.118	58.0	0.178	78.5	0.051
-2.8	0.921	5.4	0.733	17.5	0.224	38.0	0.106	58.5	0.174	79.0	0.049
-2.6	0.932	5.6	0.715	18.0	0.231	38.5	0.094	59.0	0.169	79.5	0.048
-2.4	0.941	5.8	0.696	18.5	0.234	39.0	0.081	59.5	0.164	80.0	0.047
-2.2	0.950	6.0	0.677	19.0	0.234	39.5	0.067	60.0	0.159	80.5	0.046
-2.0	0.958	6.2	0.658	19.5	0.231	40.0	0.053	60.5	0.155	81.0	0.045
-1.8	0.966	6.4	0.638	20.0	0.225	40.5	0.039	61.0	0.151	81.5	0.044
-1.6	0.973	6.6	0.618	20.5	0.216	41.0	0.024	61.5	0.147	82.0	0.043
-1.4	0.979	6.8	0.598	21.0	0.205	41.5	0.009	62.0	0.143	82.5	0.042
-1.2	0.984	7.0	0.577	21.5	0.192	42.0	0.006	62.5	0.138	83.0	0.041
-1.0	0.988	7.2	0.557	22.0	0.177	42.5	0.021	63.0	0.134	83.5	0.040
-0.8	0.992	7.4	0.536	22.5	0.160	43.0	0.036	63.5	0.129	84.0	0.039
-0.6	0.995	7.6	0.515	23.0	0.141	43.5	0.050	64.0	0.124	84.5	0.038
-0.4	0.998	7.8	0.494	23.5	0.122	44.0	0.064	64.5	0.119	85.0	0.038
-0.2	0.999	8.0	0.473	24.0	0.102	44.5	0.077	65.0	0.114	85.5	0.037
0.0	1.000	8.2	0.451	24.5	0.081	45.0	0.090	65.5	0.111	86.0	0.036
0.2	0.999	8.4	0.430	25.0	0.060	45.5	0.103	66.0	0.108	86.5	0.036
0.4	0.998	8.6	0.409	25.5	0.038	46.0	0.115	66.5	0.105	87.0	0.035
0.6	0.995	8.8	0.388	26.0	0.017	46.5	0.126	67.0	0.101	87.5	0.034
0.8	0.992	9.0	0.366	26.5	0.004	47.0	0.136	67.5	0.098	88.0	0.034
1.0	0.988	9.2	0.345	27.0	0.024	47.5	0.146	68.0	0.095	88.5	0.034
1.2	0.984	9.4	0.324	27.5	0.043	48.0	0.154	68.5	0.092	89.0	0.033
1.4	0.979	9.6	0.303	28.0	0.062	48.5	0.162	69.0	0.089	89.5	0.032
1.6	0.973	9.8	0.293	28.5	0.079	49.0	0.169	69.5	0.085	90.0	0.032
1.8	0.966	10.0	0.272	29.0	0.095	49.5	0.176	70.0	0.082		
2.0	0.958	10.2	0.252	29.5	0.109	50.0	0.181	70.5	0.080		
2.2	0.950	10.4	0.231	30.0	0.123	50.5	0.186	71.0	0.078		

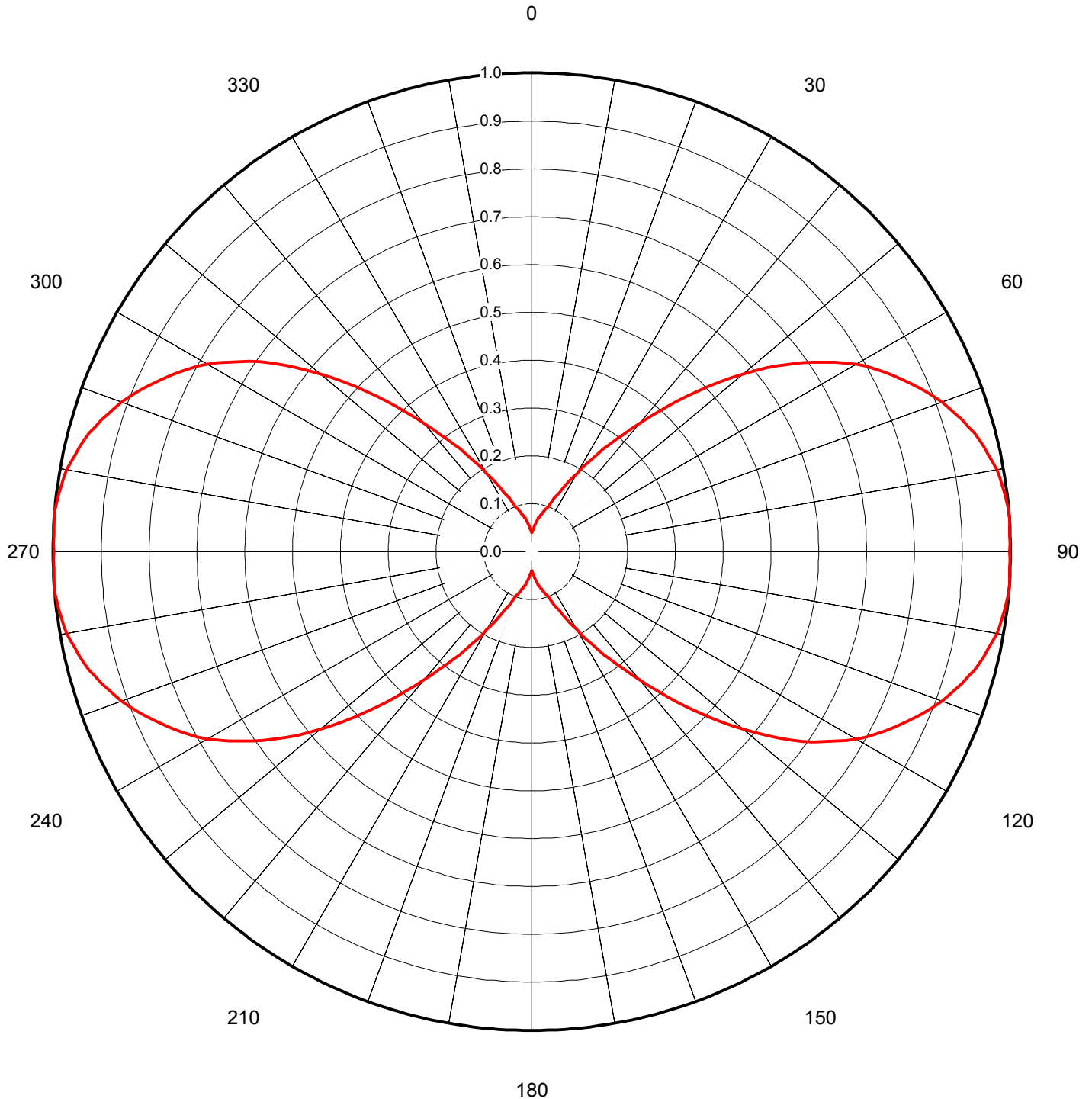


Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ	Channel	13
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

AZIMUTH PATTERN

Gain	2.63	(4.20 dB)
Calculated / Measured	Calculated	

Frequency	213.00 MHz
Drawing #	THA-P4-13





Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ	Channel	13
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

TABULATION OF AZIMUTH PATTERN

Azimuth Pattern Drawing #: **THA-P4-13**

Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
0	0.040	45	0.459	90	0.998	135	0.459	180	0.040	225	0.459	270	0.998	315	0.459
1	0.041	46	0.483	91	0.999	136	0.436	181	0.041	226	0.483	271	0.999	316	0.436
2	0.043	47	0.506	92	0.999	137	0.414	182	0.043	227	0.506	272	0.999	317	0.414
3	0.045	48	0.530	93	0.999	138	0.391	183	0.045	228	0.530	273	0.999	318	0.391
4	0.047	49	0.554	94	1.000	139	0.370	184	0.047	229	0.554	274	1.000	319	0.370
5	0.048	50	0.578	95	1.000	140	0.348	185	0.048	230	0.578	275	1.000	320	0.348
6	0.053	51	0.601	96	0.997	141	0.329	186	0.053	231	0.601	276	0.997	321	0.329
7	0.057	52	0.623	97	0.995	142	0.311	187	0.057	232	0.623	277	0.995	322	0.311
8	0.061	53	0.645	98	0.992	143	0.294	188	0.061	233	0.645	278	0.992	323	0.294
9	0.064	54	0.667	99	0.989	144	0.278	189	0.064	234	0.667	279	0.989	324	0.278
10	0.068	55	0.688	100	0.987	145	0.262	190	0.068	235	0.688	280	0.987	325	0.262
11	0.071	56	0.708	101	0.981	146	0.246	191	0.071	236	0.708	281	0.981	326	0.246
12	0.074	57	0.727	102	0.975	147	0.231	192	0.074	237	0.727	282	0.975	327	0.231
13	0.077	58	0.746	103	0.969	148	0.216	193	0.077	238	0.746	283	0.969	328	0.216
14	0.079	59	0.765	104	0.963	149	0.202	194	0.079	239	0.765	284	0.963	329	0.202
15	0.081	60	0.783	105	0.957	150	0.189	195	0.081	240	0.783	285	0.957	330	0.189
16	0.086	61	0.798	106	0.948	151	0.178	196	0.086	241	0.798	286	0.948	331	0.178
17	0.089	62	0.812	107	0.940	152	0.167	197	0.089	242	0.812	287	0.940	332	0.167
18	0.093	63	0.826	108	0.931	153	0.157	198	0.093	243	0.826	288	0.931	333	0.157
19	0.096	64	0.839	109	0.922	154	0.147	199	0.096	244	0.839	289	0.922	334	0.147
20	0.098	65	0.852	110	0.913	155	0.137	200	0.098	245	0.852	290	0.913	335	0.137
21	0.106	66	0.865	111	0.901	156	0.129	201	0.106	246	0.865	291	0.901	336	0.129
22	0.114	67	0.877	112	0.889	157	0.122	202	0.114	247	0.877	292	0.889	337	0.122
23	0.122	68	0.889	113	0.877	158	0.114	203	0.122	248	0.889	293	0.877	338	0.114
24	0.129	69	0.901	114	0.865	159	0.106	204	0.129	249	0.901	294	0.865	339	0.106
25	0.137	70	0.913	115	0.852	160	0.098	205	0.137	250	0.913	295	0.852	340	0.098
26	0.147	71	0.922	116	0.839	161	0.096	206	0.147	251	0.922	296	0.839	341	0.096
27	0.157	72	0.931	117	0.826	162	0.093	207	0.157	252	0.931	297	0.826	342	0.093
28	0.167	73	0.940	118	0.812	163	0.089	208	0.167	253	0.940	298	0.812	343	0.089
29	0.178	74	0.948	119	0.798	164	0.086	209	0.178	254	0.948	299	0.798	344	0.086
30	0.189	75	0.957	120	0.783	165	0.081	210	0.189	255	0.957	300	0.783	345	0.081
31	0.202	76	0.963	121	0.765	166	0.079	211	0.202	256	0.963	301	0.765	346	0.079
32	0.216	77	0.969	122	0.747	167	0.077	212	0.216	257	0.969	302	0.747	347	0.077
33	0.231	78	0.975	123	0.729	168	0.074	213	0.231	258	0.975	303	0.729	348	0.074
34	0.246	79	0.981	124	0.710	169	0.071	214	0.246	259	0.981	304	0.710	349	0.071
35	0.262	80	0.987	125	0.691	170	0.068	215	0.262	260	0.987	305	0.691	350	0.068
36	0.278	81	0.989	126	0.669	171	0.064	216	0.278	261	0.989	306	0.669	351	0.064
37	0.294	82	0.992	127	0.647	172	0.061	217	0.294	262	0.992	307	0.647	352	0.061
38	0.311	83	0.995	128	0.625	173	0.057	218	0.311	263	0.995	308	0.625	353	0.057
39	0.329	84	0.997	129	0.602	174	0.053	219	0.329	264	0.997	309	0.602	354	0.053
40	0.348	85	1.000	130	0.578	175	0.048	220	0.348	265	1.000	310	0.578	355	0.048
41	0.370	86	1.000	131	0.554	176	0.047	221	0.370	266	1.000	311	0.554	356	0.047
42	0.391	87	0.999	132	0.530	177	0.045	222	0.391	267	0.999	312	0.530	357	0.045
43	0.414	88	0.999	133	0.506	178	0.043	223	0.414	268	0.999	313	0.506	358	0.043
44	0.436	89	0.999	134	0.483	179	0.041	224	0.436	269	0.999	314	0.483	359	0.041



Proposal #: **DCA-9073-2** Antenna Type: **THA-P2-2H/4HD-1** Channel: **8 DTV**
 Call Letters: **KCTZ** Location: **Bozeman, MT** **13 DTV**

Electrical Specifications		Value		Remarks
		Ratio	dB	
RMS Gain at Main Lobe over Halfwave Dipole	Hpol	4.3	6.33	D8; D13: 4.8 (6.81 dB)
	Vpol			
RMS Gain at Horizontal over Halfwave Dipole	Hpol	4.3	6.33	D8; D13: 4.8 (6.81 dB)
	Vpol			
Peak Directional Gain over Halfwave Dipole	Hpol	11.8	10.72	D8; D13: 12.6 (11.02 dB)
	Vpol			
Peak Directional Gain at Horizontal over Halfwave Dipole	Hpol	11.8	10.72	D8; D13: 12.6 (11.00 dB)
	Vpol			
Circularity		dB		
Axial Ratio		dB		
Beam Tilt		0.00 deg		D8; D13: 0.00 deg
Average Power DTV		5 kW	6.99 dBk	+5 kW DTV power
Antenna Input: T/L		3 1/8 in	50.0 ohm	Type: EIA/DCA
Maximum Antenna Input VSWR				
		Channel	1.10 : 1	
Patterns	Azimuth	THA-P4-8	THA-P4-13	
	Elevation	02H043000	02H043000-90	D8
		02H048000	02H048000-90	D13
Mechanical Specifications		Metric	English	Preliminary
Height with Lightning Protector	H4			Side mounted
Height Less Lightning Protector	H2			
Height of Center of Radiation	H3			
Basic Wind Speed	V			TIA/EIA-222-F.
Force Coeff. x Projected Area	CaAc			Excludes Mounts
Moment Arm	D1			
Force Coeff. x Projected Area	CaAc			
Moment Arm	D3			
Pole Bury Length	D2			
Weight	W			Excludes Mounts
Antenna designed in accordance with AISC specifications for design of structural steel for building as prescribed by TIA/EIA-222-F.				

NOTE: **For loads see specifications sheet for Ch 7 & 9**

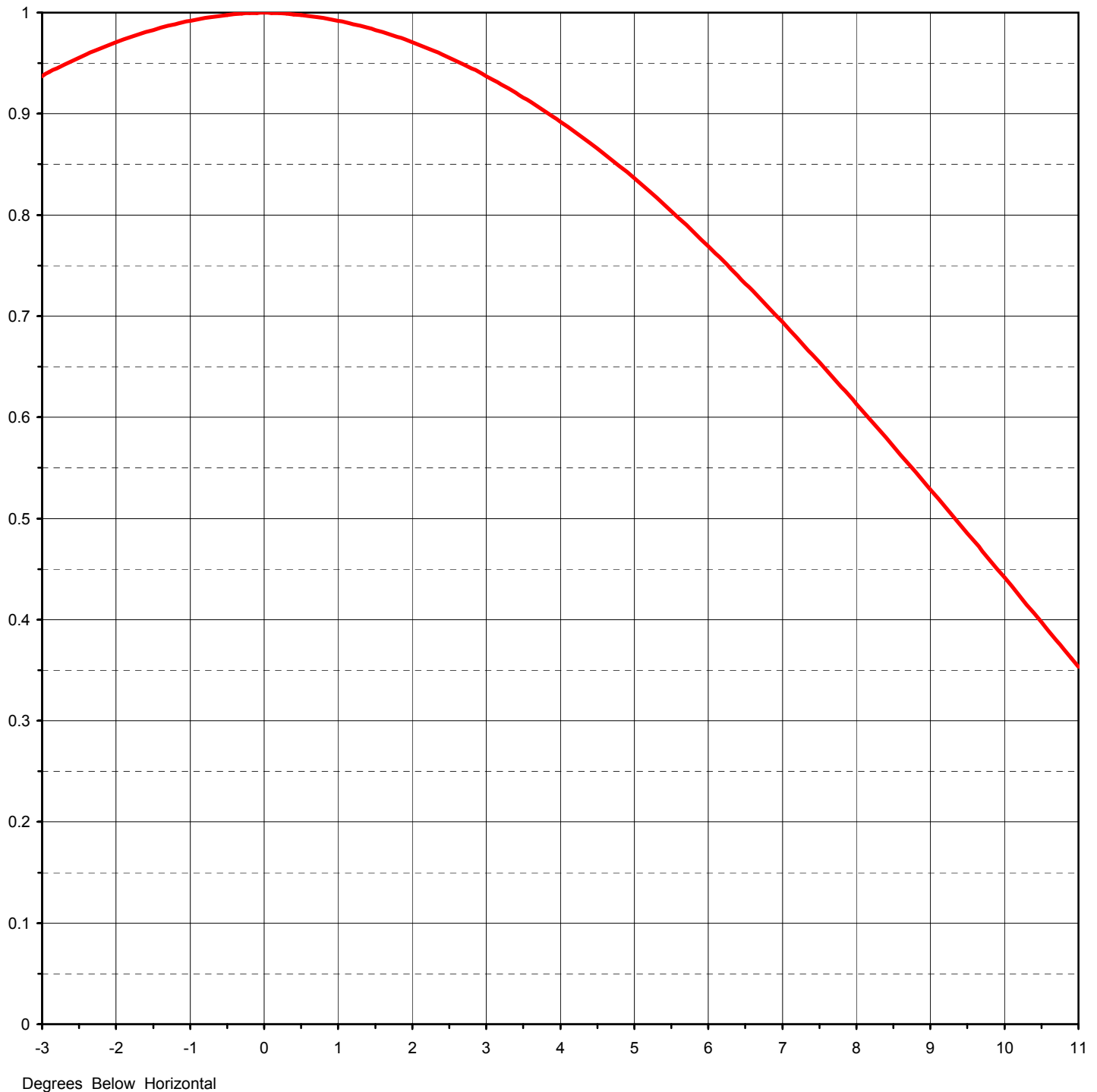
Prepared By : **SRR** Approved By : **RN**
 Original Date : **1-Dec-00** Revision: **2** Rev. Date: **15-Jan-01**



Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ, KUSM	Channel	7
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

ELEVATION PATTERN

RMS Gain at Main Lobe	4.20 (6.23 dB)	Beam Tilt	0.00 deg
RMS Gain at Horizontal	4.20 (6.23 dB)	Frequency	177.00 MHz
Calculated / Measured	Calculated	Drawing #	02H042000



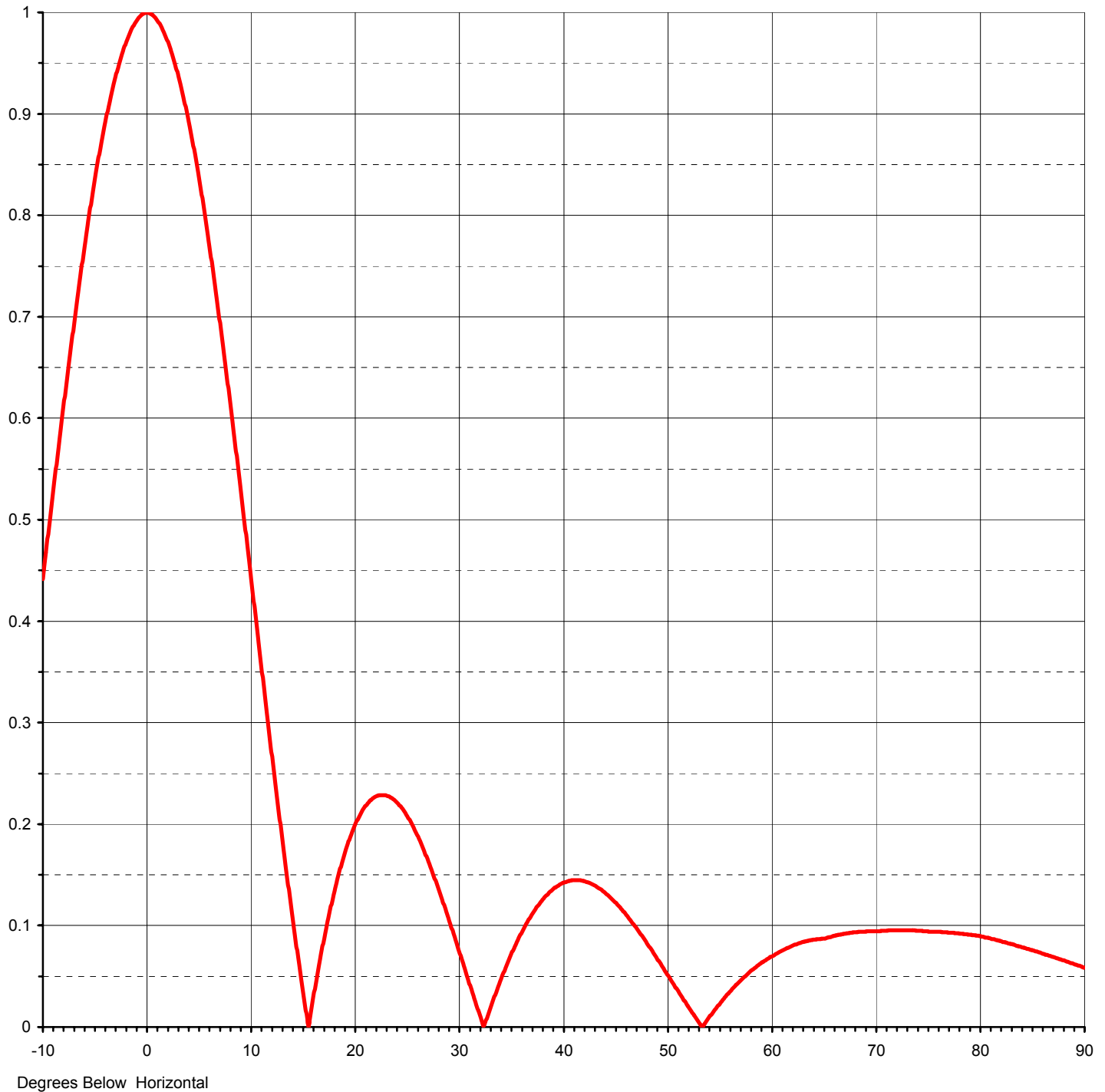


Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ, KUSM	Channel	7
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

ELEVATION PATTERN

RMS Gain at Main Lobe	4.20	(6.23 dB)
RMS Gain at Horizontal	4.20	(6.23 dB)
Calculated / Measured	Calculated	

Beam Tilt	0.00 deg
Frequency	177.00 MHz
Drawing #	02H042000-90





Proposal Number **DCA-9073** Revision: **2**
 Date **15-Jan-01**
 Call Letters **KCTZ, KUSM** Channel **7**
 Location **Bozeman, MT**
 Customer **Cordillera**
 Antenna Type **THA-P2-2H/4HD-1**

TABULATION OF ELEVATION PATTERN

Elevation Pattern Drawing #: **02H042000-90**

Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.442	2.4	0.959	10.6	0.397	30.5	0.060	51.0	0.037	71.5	0.095
-9.5	0.485	2.6	0.952	10.8	0.380	31.0	0.045	51.5	0.029	72.0	0.095
-9.0	0.529	2.8	0.945	11.0	0.362	31.5	0.029	52.0	0.021	72.5	0.095
-8.5	0.571	3.0	0.937	11.5	0.318	32.0	0.013	52.5	0.013	73.0	0.095
-8.0	0.613	3.2	0.929	12.0	0.275	32.5	0.002	53.0	0.006	73.5	0.095
-7.5	0.654	3.4	0.921	12.5	0.233	33.0	0.017	53.5	0.002	74.0	0.095
-7.0	0.694	3.6	0.912	13.0	0.192	33.5	0.031	54.0	0.009	74.5	0.095
-6.5	0.732	3.8	0.902	13.5	0.152	34.0	0.045	54.5	0.015	75.0	0.094
-6.0	0.769	4.0	0.892	14.0	0.113	34.5	0.058	55.0	0.022	75.5	0.094
-5.5	0.804	4.2	0.882	14.5	0.076	35.0	0.070	55.5	0.028	76.0	0.094
-5.0	0.836	4.4	0.871	15.0	0.040	35.5	0.082	56.0	0.034	76.5	0.093
-4.5	0.866	4.6	0.860	15.5	0.007	36.0	0.092	56.5	0.040	77.0	0.093
-4.0	0.892	4.8	0.848	16.0	0.025	36.5	0.102	57.0	0.045	77.5	0.093
-3.5	0.916	5.0	0.836	16.5	0.055	37.0	0.110	57.5	0.050	78.0	0.092
-3.0	0.937	5.2	0.824	17.0	0.082	37.5	0.118	58.0	0.055	78.5	0.092
-2.8	0.945	5.4	0.811	17.5	0.107	38.0	0.125	58.5	0.059	79.0	0.091
-2.6	0.952	5.6	0.797	18.0	0.130	38.5	0.130	59.0	0.063	79.5	0.090
-2.4	0.959	5.8	0.783	18.5	0.150	39.0	0.135	59.5	0.066	80.0	0.090
-2.2	0.965	6.0	0.769	19.0	0.169	39.5	0.139	60.0	0.069	80.5	0.088
-2.0	0.971	6.2	0.754	19.5	0.184	40.0	0.142	60.5	0.072	81.0	0.087
-1.8	0.976	6.4	0.740	20.0	0.198	40.5	0.144	61.0	0.075	81.5	0.086
-1.6	0.981	6.6	0.725	20.5	0.208	41.0	0.145	61.5	0.078	82.0	0.084
-1.4	0.985	6.8	0.710	21.0	0.217	41.5	0.145	62.0	0.080	82.5	0.083
-1.2	0.989	7.0	0.694	21.5	0.223	42.0	0.144	62.5	0.082	83.0	0.082
-1.0	0.992	7.2	0.678	22.0	0.227	42.5	0.142	63.0	0.083	83.5	0.080
-0.8	0.994	7.4	0.662	22.5	0.229	43.0	0.140	63.5	0.085	84.0	0.079
-0.6	0.997	7.6	0.646	23.0	0.228	43.5	0.137	64.0	0.086	84.5	0.077
-0.4	0.998	7.8	0.630	23.5	0.226	44.0	0.133	64.5	0.087	85.0	0.075
-0.2	0.999	8.0	0.613	24.0	0.222	44.5	0.128	65.0	0.087	85.5	0.074
0.0	1.000	8.2	0.597	24.5	0.217	45.0	0.123	65.5	0.089	86.0	0.072
0.2	0.999	8.4	0.580	25.0	0.209	45.5	0.118	66.0	0.090	86.5	0.071
0.4	0.998	8.6	0.563	25.5	0.200	46.0	0.112	66.5	0.091	87.0	0.069
0.6	0.997	8.8	0.546	26.0	0.190	46.5	0.105	67.0	0.092	87.5	0.067
0.8	0.994	9.0	0.529	26.5	0.178	47.0	0.099	67.5	0.093	88.0	0.066
1.0	0.992	9.2	0.511	27.0	0.166	47.5	0.091	68.0	0.093	88.5	0.064
1.2	0.989	9.4	0.494	27.5	0.153	48.0	0.084	68.5	0.094	89.0	0.062
1.4	0.985	9.6	0.477	28.0	0.138	48.5	0.076	69.0	0.094	89.5	0.060
1.6	0.981	9.8	0.468	28.5	0.123	49.0	0.068	69.5	0.094	90.0	0.058
1.8	0.976	10.0	0.450	29.0	0.108	49.5	0.061	70.0	0.094		
2.0	0.971	10.2	0.433	29.5	0.093	50.0	0.053	70.5	0.095		
2.2	0.965	10.4	0.415	30.0	0.077	50.5	0.045	71.0	0.095		

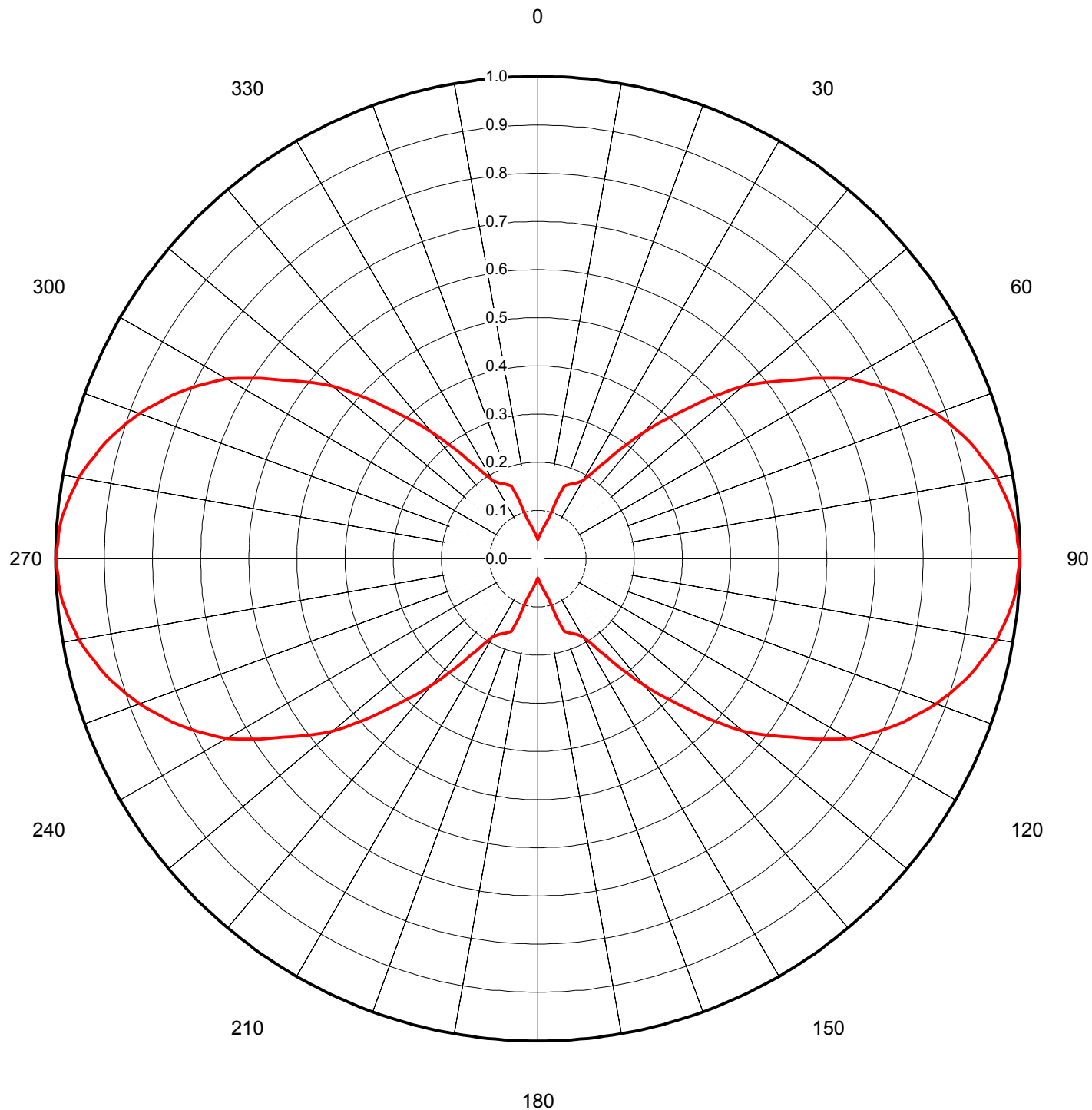


Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ, KUSM	Channel	7
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

AZIMUTH PATTERN

Gain	2.78	(4.44 dB)
Calculated / Measured	Calculated	

Frequency	177.00 MHz
Drawing #	THA-P2-7





Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ, KUSM	Channel	7
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

TABULATION OF AZIMUTH PATTERN

Azimuth Pattern Drawing #: **THA-P2-7**

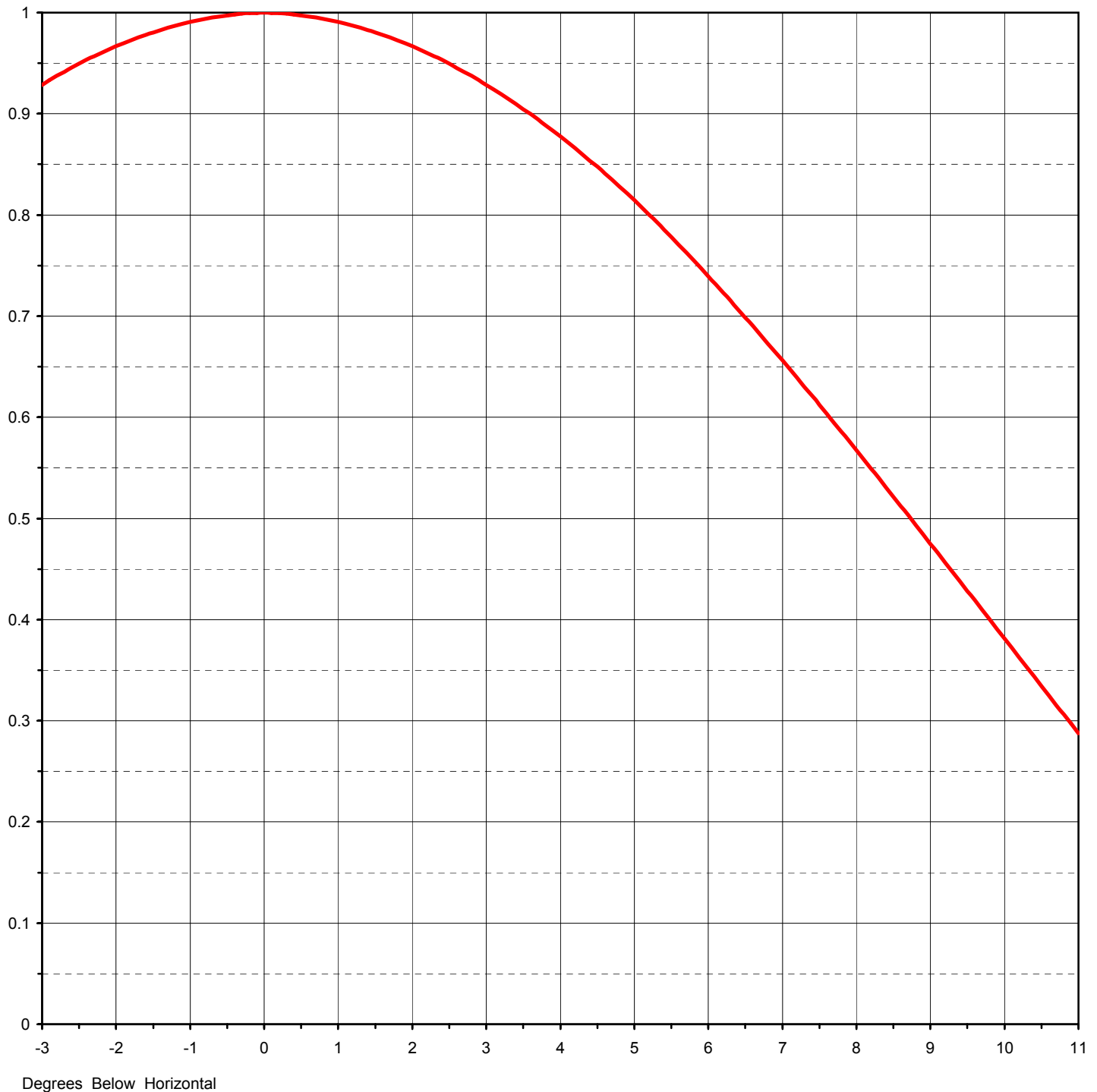
Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
0	0.040	45	0.442	90	1.000	135	0.442	180	0.040	225	0.442	270	1.000	315	0.442
1	0.042	46	0.465	91	0.998	136	0.421	181	0.042	226	0.465	271	0.998	316	0.421
2	0.043	47	0.488	92	0.996	137	0.401	182	0.043	227	0.488	272	0.996	317	0.401
3	0.045	48	0.511	93	0.995	138	0.381	183	0.045	228	0.511	273	0.995	318	0.381
4	0.047	49	0.534	94	0.993	139	0.361	184	0.047	229	0.534	274	0.993	319	0.361
5	0.049	50	0.556	95	0.991	140	0.342	185	0.049	230	0.556	275	0.991	320	0.342
6	0.052	51	0.575	96	0.986	141	0.322	186	0.052	231	0.575	276	0.986	321	0.322
7	0.055	52	0.592	97	0.981	142	0.302	187	0.055	232	0.592	277	0.981	322	0.302
8	0.058	53	0.610	98	0.976	143	0.283	188	0.058	233	0.610	278	0.976	323	0.283
9	0.061	54	0.628	99	0.972	144	0.264	189	0.061	234	0.628	279	0.972	324	0.264
10	0.064	55	0.645	100	0.967	145	0.247	190	0.064	235	0.645	280	0.967	325	0.247
11	0.069	56	0.666	101	0.959	146	0.232	191	0.069	236	0.666	281	0.959	326	0.232
12	0.073	57	0.686	102	0.952	147	0.219	192	0.073	237	0.686	282	0.952	327	0.219
13	0.077	58	0.706	103	0.944	148	0.207	193	0.077	238	0.706	283	0.944	328	0.207
14	0.081	59	0.726	104	0.937	149	0.196	194	0.081	239	0.726	284	0.937	329	0.196
15	0.084	60	0.746	105	0.929	150	0.186	195	0.084	240	0.746	285	0.929	330	0.186
16	0.099	61	0.760	106	0.919	151	0.182	196	0.099	241	0.760	286	0.919	331	0.182
17	0.114	62	0.775	107	0.910	152	0.179	197	0.114	242	0.775	287	0.910	332	0.179
18	0.130	63	0.790	108	0.900	153	0.176	198	0.130	243	0.790	288	0.900	333	0.176
19	0.145	64	0.804	109	0.890	154	0.174	199	0.145	244	0.804	289	0.890	334	0.174
20	0.160	65	0.818	110	0.880	155	0.171	200	0.160	245	0.818	290	0.880	335	0.171
21	0.163	66	0.831	111	0.868	156	0.169	201	0.163	246	0.831	291	0.868	336	0.169
22	0.165	67	0.843	112	0.856	157	0.167	202	0.165	247	0.843	292	0.856	337	0.167
23	0.167	68	0.856	113	0.843	158	0.165	203	0.167	248	0.856	293	0.843	338	0.165
24	0.169	69	0.868	114	0.831	159	0.163	204	0.169	249	0.868	294	0.831	339	0.163
25	0.171	70	0.880	115	0.818	160	0.160	205	0.171	250	0.880	295	0.818	340	0.160
26	0.174	71	0.890	116	0.804	161	0.145	206	0.174	251	0.890	296	0.804	341	0.145
27	0.176	72	0.900	117	0.790	162	0.130	207	0.176	252	0.900	297	0.790	342	0.130
28	0.179	73	0.910	118	0.775	163	0.114	208	0.179	253	0.910	298	0.775	343	0.114
29	0.182	74	0.919	119	0.760	164	0.099	209	0.182	254	0.919	299	0.760	344	0.099
30	0.186	75	0.929	120	0.746	165	0.084	210	0.186	255	0.929	300	0.746	345	0.084
31	0.196	76	0.937	121	0.726	166	0.081	211	0.196	256	0.937	301	0.726	346	0.081
32	0.207	77	0.944	122	0.706	167	0.077	212	0.207	257	0.944	302	0.706	347	0.077
33	0.219	78	0.952	123	0.686	168	0.073	213	0.219	258	0.952	303	0.686	348	0.073
34	0.232	79	0.959	124	0.666	169	0.069	214	0.232	259	0.959	304	0.666	349	0.069
35	0.247	80	0.967	125	0.645	170	0.064	215	0.247	260	0.967	305	0.645	350	0.064
36	0.264	81	0.972	126	0.628	171	0.061	216	0.264	261	0.972	306	0.628	351	0.061
37	0.283	82	0.976	127	0.610	172	0.058	217	0.283	262	0.976	307	0.610	352	0.058
38	0.302	83	0.981	128	0.592	173	0.055	218	0.302	263	0.981	308	0.592	353	0.055
39	0.322	84	0.986	129	0.575	174	0.052	219	0.322	264	0.986	309	0.575	354	0.052
40	0.342	85	0.991	130	0.556	175	0.049	220	0.342	265	0.991	310	0.556	355	0.049
41	0.361	86	0.993	131	0.534	176	0.047	221	0.361	266	0.993	311	0.534	356	0.047
42	0.381	87	0.995	132	0.511	177	0.045	222	0.381	267	0.995	312	0.511	357	0.045
43	0.401	88	0.996	133	0.488	178	0.043	223	0.401	268	0.996	313	0.488	358	0.043
44	0.421	89	0.998	134	0.465	179	0.042	224	0.421	269	0.998	314	0.465	359	0.042



Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ, KUSM-D	Channel	9
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

ELEVATION PATTERN

RMS Gain at Main Lobe	4.40	(6.43 dB)	Beam Tilt	0.00 deg
RMS Gain at Horizontal	4.40	(6.43 dB)	Frequency	189.00 MHz
Calculated / Measured	Calculated		Drawing #	02H044000



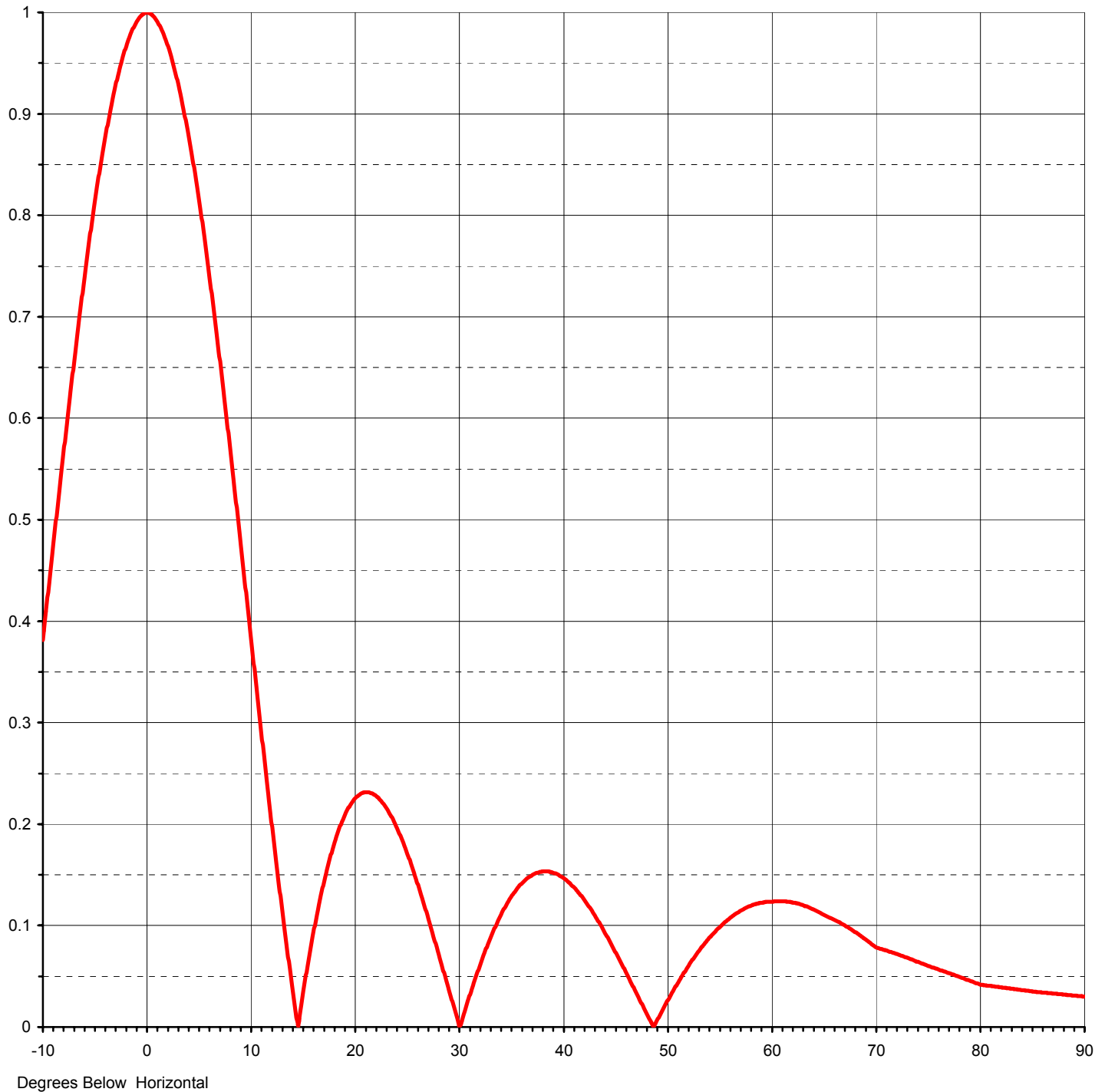


Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ, KUSM-D	Channel	9
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

ELEVATION PATTERN

RMS Gain at Main Lobe	4.40	(6.43 dB)
RMS Gain at Horizontal	4.40	(6.43 dB)
Calculated / Measured	Calculated	

Beam Tilt	0.00 deg
Frequency	189.00 MHz
Drawing #	02H044000-90





Proposal Number **DCA-9073** Revision: **2**
 Date **15-Jan-01**
 Call Letters **KCTZ, KUSM-I** Channel **9**
 Location **Bozeman, MT**
 Customer **Cordillera**
 Antenna Type **THA-P2-2H/4HD-1**

TABULATION OF ELEVATION PATTERN

Elevation Pattern Drawing #: **02H044000-90**

Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.382	2.4	0.953	10.6	0.334	30.5	0.012	51.0	0.043	71.5	0.074
-9.5	0.428	2.6	0.946	10.8	0.316	31.0	0.029	51.5	0.051	72.0	0.072
-9.0	0.475	2.8	0.937	11.0	0.297	31.5	0.044	52.0	0.059	72.5	0.070
-8.5	0.521	3.0	0.929	11.5	0.251	32.0	0.059	52.5	0.067	73.0	0.068
-8.0	0.567	3.2	0.919	12.0	0.206	32.5	0.073	53.0	0.074	73.5	0.066
-7.5	0.612	3.4	0.910	12.5	0.163	33.0	0.086	53.5	0.081	74.0	0.064
-7.0	0.656	3.6	0.900	13.0	0.121	33.5	0.098	54.0	0.087	74.5	0.062
-6.5	0.699	3.8	0.889	13.5	0.081	34.0	0.109	54.5	0.093	75.0	0.060
-6.0	0.739	4.0	0.878	14.0	0.042	34.5	0.119	55.0	0.098	75.5	0.058
-5.5	0.778	4.2	0.866	14.5	0.006	35.0	0.127	55.5	0.102	76.0	0.057
-5.0	0.815	4.4	0.854	15.0	0.028	35.5	0.135	56.0	0.107	76.5	0.055
-4.5	0.848	4.6	0.841	15.5	0.060	36.0	0.141	56.5	0.111	77.0	0.053
-4.0	0.878	4.8	0.828	16.0	0.089	36.5	0.146	57.0	0.114	77.5	0.051
-3.5	0.905	5.0	0.815	16.5	0.115	37.0	0.149	57.5	0.117	78.0	0.049
-3.0	0.929	5.2	0.800	17.0	0.139	37.5	0.152	58.0	0.119	78.5	0.047
-2.8	0.937	5.4	0.786	17.5	0.160	38.0	0.153	58.5	0.121	79.0	0.046
-2.6	0.946	5.6	0.771	18.0	0.178	38.5	0.153	59.0	0.122	79.5	0.044
-2.4	0.953	5.8	0.755	18.5	0.194	39.0	0.152	59.5	0.123	80.0	0.042
-2.2	0.960	6.0	0.739	19.0	0.207	39.5	0.150	60.0	0.123	80.5	0.041
-2.0	0.967	6.2	0.723	19.5	0.217	40.0	0.147	60.5	0.124	81.0	0.041
-1.8	0.973	6.4	0.707	20.0	0.225	40.5	0.143	61.0	0.124	81.5	0.040
-1.6	0.978	6.6	0.690	20.5	0.229	41.0	0.139	61.5	0.124	82.0	0.039
-1.4	0.983	6.8	0.673	21.0	0.231	41.5	0.133	62.0	0.123	82.5	0.038
-1.2	0.987	7.0	0.656	21.5	0.231	42.0	0.126	62.5	0.122	83.0	0.038
-1.0	0.991	7.2	0.639	22.0	0.228	42.5	0.119	63.0	0.120	83.5	0.037
-0.8	0.994	7.4	0.621	22.5	0.224	43.0	0.111	63.5	0.119	84.0	0.036
-0.6	0.996	7.6	0.603	23.0	0.217	43.5	0.103	64.0	0.116	84.5	0.036
-0.4	0.998	7.8	0.586	23.5	0.208	44.0	0.094	64.5	0.113	85.0	0.035
-0.2	0.999	8.0	0.567	24.0	0.198	44.5	0.085	65.0	0.110	85.5	0.034
0.0	1.000	8.2	0.549	24.5	0.186	45.0	0.075	65.5	0.108	86.0	0.034
0.2	0.999	8.4	0.531	25.0	0.173	45.5	0.065	66.0	0.106	86.5	0.034
0.4	0.998	8.6	0.512	25.5	0.159	46.0	0.055	66.5	0.103	87.0	0.033
0.6	0.996	8.8	0.494	26.0	0.143	46.5	0.045	67.0	0.100	87.5	0.032
0.8	0.994	9.0	0.475	26.5	0.127	47.0	0.035	67.5	0.097	88.0	0.032
1.0	0.991	9.2	0.456	27.0	0.110	47.5	0.025	68.0	0.093	88.5	0.032
1.2	0.987	9.4	0.438	27.5	0.093	48.0	0.014	68.5	0.090	89.0	0.031
1.4	0.983	9.6	0.419	28.0	0.075	48.5	0.004	69.0	0.086	89.5	0.031
1.6	0.978	9.8	0.410	28.5	0.057	49.0	0.005	69.5	0.082	90.0	0.030
1.8	0.973	10.0	0.391	29.0	0.040	49.5	0.015	70.0	0.078		
2.0	0.967	10.2	0.372	29.5	0.022	50.0	0.024	70.5	0.077		
2.2	0.960	10.4	0.353	30.0	0.004	50.5	0.034	71.0	0.075		

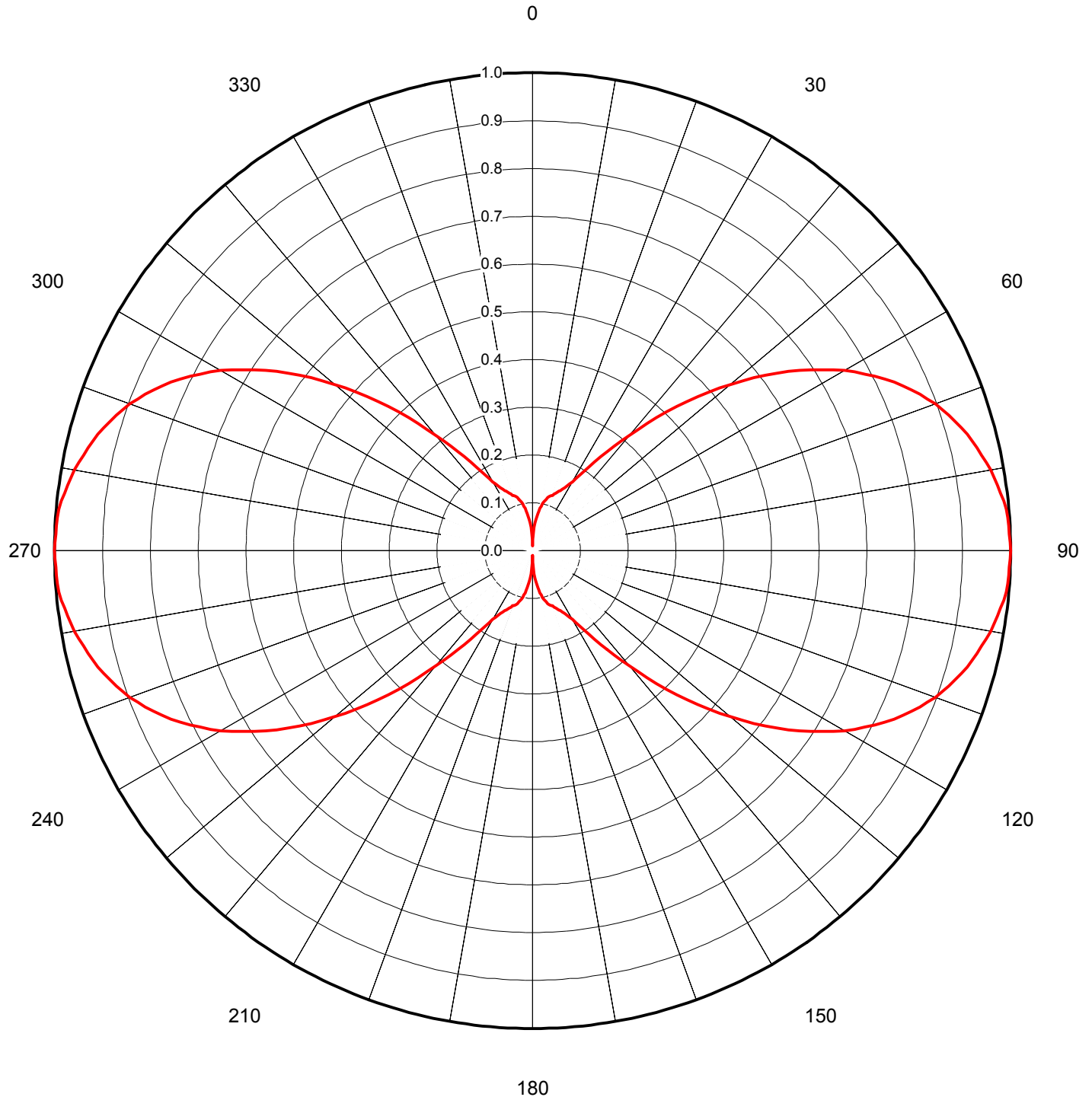


Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ, KUSM-L	Channel	9
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

AZIMUTH PATTERN

Gain **2.76** **(4.41 dB)**
Calculated / Measured **Calculated**

Frequency **189.00 MHz**
Drawing # **THA-P2-9**





Proposal Number	DCA-9073	Revision:	2
Date	15-Jan-01		
Call Letters	KCTZ, KUSM-DT	Channel	9
Location	Bozeman, MT		
Customer	Cordillera		
Antenna Type	THA-P2-2H/4HD-1		

TABULATION OF AZIMUTH PATTERN

Azimuth Pattern Drawing #: **THA-P2-9**

Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
0	0.010	45	0.426	90	1.000	135	0.426	180	0.010	225	0.426	270	1.000	315	0.426
1	0.020	46	0.449	91	0.999	136	0.403	181	0.020	226	0.449	271	0.999	316	0.403
2	0.030	47	0.472	92	0.998	137	0.381	182	0.030	227	0.472	272	0.998	317	0.381
3	0.040	48	0.495	93	0.997	138	0.358	183	0.040	228	0.495	273	0.997	318	0.358
4	0.049	49	0.518	94	0.996	139	0.336	184	0.049	229	0.518	274	0.996	319	0.336
5	0.058	50	0.541	95	0.995	140	0.314	185	0.058	230	0.541	275	0.995	320	0.314
6	0.065	51	0.564	96	0.990	141	0.295	186	0.065	231	0.564	276	0.990	321	0.295
7	0.072	52	0.587	97	0.986	142	0.276	187	0.072	232	0.587	277	0.986	322	0.276
8	0.078	53	0.609	98	0.982	143	0.259	188	0.078	233	0.609	278	0.982	323	0.259
9	0.084	54	0.631	99	0.977	144	0.242	189	0.084	234	0.631	279	0.977	324	0.242
10	0.089	55	0.653	100	0.973	145	0.226	190	0.089	235	0.653	280	0.973	325	0.226
11	0.095	56	0.674	101	0.967	146	0.212	191	0.095	236	0.674	281	0.967	326	0.212
12	0.100	57	0.694	102	0.960	147	0.199	192	0.100	237	0.694	282	0.960	327	0.199
13	0.105	58	0.714	103	0.954	148	0.187	193	0.105	238	0.714	283	0.954	328	0.187
14	0.108	59	0.734	104	0.948	149	0.176	194	0.108	239	0.734	284	0.948	329	0.176
15	0.112	60	0.753	105	0.941	150	0.167	195	0.112	240	0.753	285	0.941	330	0.167
16	0.115	61	0.770	106	0.933	151	0.160	196	0.115	241	0.770	286	0.933	331	0.160
17	0.119	62	0.787	107	0.924	152	0.154	197	0.119	242	0.787	287	0.924	332	0.154
18	0.121	63	0.803	108	0.915	153	0.148	198	0.121	243	0.803	288	0.915	333	0.148
19	0.122	64	0.819	109	0.906	154	0.143	199	0.122	244	0.819	289	0.906	334	0.143
20	0.123	65	0.835	110	0.897	155	0.138	200	0.123	245	0.835	290	0.897	335	0.138
21	0.126	66	0.848	111	0.885	156	0.136	201	0.126	246	0.848	291	0.885	336	0.136
22	0.130	67	0.861	112	0.873	157	0.133	202	0.130	247	0.861	292	0.873	337	0.133
23	0.133	68	0.873	113	0.861	158	0.130	203	0.133	248	0.873	293	0.861	338	0.130
24	0.136	69	0.885	114	0.848	159	0.126	204	0.136	249	0.885	294	0.848	339	0.126
25	0.138	70	0.897	115	0.835	160	0.123	205	0.138	250	0.897	295	0.835	340	0.123
26	0.143	71	0.906	116	0.819	161	0.122	206	0.143	251	0.906	296	0.819	341	0.122
27	0.148	72	0.915	117	0.803	162	0.121	207	0.148	252	0.915	297	0.803	342	0.121
28	0.154	73	0.924	118	0.787	163	0.119	208	0.154	253	0.924	298	0.787	343	0.119
29	0.160	74	0.933	119	0.770	164	0.115	209	0.160	254	0.933	299	0.770	344	0.115
30	0.167	75	0.941	120	0.753	165	0.112	210	0.167	255	0.941	300	0.753	345	0.112
31	0.176	76	0.948	121	0.734	166	0.108	211	0.176	256	0.948	301	0.734	346	0.108
32	0.187	77	0.954	122	0.714	167	0.105	212	0.187	257	0.954	302	0.714	347	0.105
33	0.199	78	0.960	123	0.694	168	0.100	213	0.199	258	0.960	303	0.694	348	0.100
34	0.212	79	0.967	124	0.674	169	0.095	214	0.212	259	0.967	304	0.674	349	0.095
35	0.226	80	0.973	125	0.653	170	0.089	215	0.226	260	0.973	305	0.653	350	0.089
36	0.242	81	0.977	126	0.631	171	0.084	216	0.242	261	0.977	306	0.631	351	0.084
37	0.259	82	0.982	127	0.609	172	0.078	217	0.259	262	0.982	307	0.609	352	0.078
38	0.276	83	0.986	128	0.587	173	0.072	218	0.276	263	0.986	308	0.587	353	0.072
39	0.295	84	0.990	129	0.564	174	0.065	219	0.295	264	0.990	309	0.564	354	0.065
40	0.314	85	0.995	130	0.541	175	0.058	220	0.314	265	0.995	310	0.541	355	0.058
41	0.336	86	0.996	131	0.518	176	0.049	221	0.336	266	0.996	311	0.518	356	0.049
42	0.358	87	0.997	132	0.495	177	0.040	222	0.358	267	0.997	312	0.495	357	0.040
43	0.381	88	0.998	133	0.472	178	0.030	223	0.381	268	0.998	313	0.472	358	0.030
44	0.403	89	0.999	134	0.449	179	0.020	224	0.403	269	0.999	314	0.449	359	0.020

