EXHIBIT E

ENGINEERING STATEMENT RE
REQUEST FOR LICENSE
(FCC FILE NO. 0000107900)
ON BEHALF OF
MONTANA STATE UNIVERSITY
KUSM-TV, BOZEMAN, MONTANA
CHANNEL 8 17.9 KW (H)/5.37 KW (V) ERP
212.8 METERS HAAT
JUNE 2020

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

Introduction

This engineering statement has been prepared on behalf of Montana State University, licensee of KUSM-TV in support of its request for application for license for the outstanding construction permit (FCC File No. 0000107900) of the constructed DTV facilities at the High Flat site.

Transmitter Site

The DTV antenna is a side-mounted to a self-supporting tower (see Exhibit E-1). The coordinates of the existing tower are as follows:

North Latitude: 45º 38' 15.3"

West Longitude: 111º 16' 04.2"

NAD-27

North Latitude: 45° 38’ 15.1”

West Longitude: 111° 16’ 07”

NAD-83

Provided in Exhibit E-1A is the plot of the proposed transmitter site. The proposed site is plotted on the latest 7.5 minute U.S.G.S. quadrangle map.

Equipment Data

Antenna:	ERI, Type ATW4V5-ESWCX-8H, or equivalent. This is a directional elliptically polarized antenna with 1.25 electrical beam tilt. All exhibits required by Section 73.625 of the Commission’s rules have been included as Exhibit E-2.
Transmission Line:	54.8 meters (180 feet) of ERI, Type HJ8-50B air dielectric, 3 inch, 50 ohm or equivalent, loss 0.198 dB/100 feet

Power Data

Transmitter output		4.30 kW	6.34 dBk
Transmission line efficiency/loss		92.11%	0.357 dB
Antenna Input		3.96 kW	5.98 dBk
Antenna Gain (DA)	Horizontal	4.52	6.55 dBd
	Vertical	1.35	1.32 dBd
Maximum Effective Radiated Power (ERP)	Horizontal	17.9 kW	12.53 dBk
	Vertical	5.37 kW	7.30 dBk

Elevation Data

Vertical dimension of Channel 8 antenna including all appurtenances	8.9 meters (29.1 feet)
Elevation of site above mean sea level	1717.7 meters (5635.5 feet)
Overall height above ground of the proposed antenna structure including all appurtenances	60.7 meters (199 feet)
Overall height above mean sea level of proposed antenna structure	1778.4 meters (5834.5 feet)
Center of radiation of proposed DTV Channel 8 antenna above ground	44.8 meters (147 feet)
Center of radiation of proposed DTV Channel 8 antenna above mean sea level	1762.5 meters (5785.5 feet)
Antenna height above average terrain	212.8 meters

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

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 1-second NGDC terrain data as determined by TVStudy 2.2 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.

Table I provides a tabulation by azimuth angle every 10 degrees beginning with True North, effective antenna height in meters, effective radiated power and distance in km to each contour.

Utilizing the formula in Section 73.625(b)(2) of the Rules for the effective heights, it is found that the depression angle, $A_{h,}$ varies from 0.167 to 0.518 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. A map is included as Exhibit E-3 showing the predicted contours. This map shows the computed coverage contour by the operation 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 KUSM-DT operation.

The RFF contribution of each station will be calculated using the following formula:

$$S = \frac{33.4(F^2)\ \text{Total ERP}}{R^2}$$

where:

S = power density in $\mu W/cm^2$
F = relative field factor

Total ERP = ERP Horizontal Polarization + ERP Vertical Polarization
R = RCAGL - 2 meters

ERP = RMS ERP in watts for FM and DTV Stations

The RFF study will consider the following stations located within 0.020 km.

Call Letters	Channel	ERP kW	Center of Radiation Above Ground Meters
Proposed	8	17.9 kW (H)	44.8
KUSM-TV		5.37 kW (V)	44.8
KBZK (CP)	13	13.9 kW (H)	49.9

In order to ensure compliance with FCC guidelines for permissible exposure transmitter area subject to levels of RF energy is confined within a fenced area with a locked gate. In addition to the fencing surrounding the transmitter site, the area is rural and remote. The remote site is not likely to be visited by the public and the area will be marked by appropriate warning signs.

For DTV, Channel 8, KUSM-TV operation, employs an ERI, Type ATW4V5-ESWCX-8H or equivalent antenna. The maximum directional ERP for the KUSM-TV operation will be 17.9 kW(H) and 5.37 kW(V), at a radiation center of 44.8 meters above ground. Assuming a relative downward radiation factor of approximately 0.211 towards (50º to 90º) the ground in the vicinity of the tower, the RFF in the vicinity of the base of the tower will be less than 2 percent of the maximum allowed for the controlled exposure and less than ten percent maximum allowed for uncontrolled exposure to the general population.

Detailed Calculation

KUSM-DT DTV Facility

Channel 8	Freq:	180-186 MHz range
	Total ERP =	23.3 kW (H&V)
	Polarization =	Elliptical
	R=RCAGL -2 meters =	42.8 meters

KUSM-DT proposes to utilize a ERI, Type ATW4V5-ESWCX-8H elliptical antenna with 1.25° electrical beam tilt. The manufacturer's vertical plane pattern for this antenna is included in Exhibit E-2. Based on this plot, the field factor will be less than 0.211 at any angle greater than 50-90 degrees below the horizon. A value of 0.211 will be used in the calculation.

$S = \frac{33.4\ (F^2)\ \text{Total ERP (watts)}}{R^2}$

Tot ERP = 23,300 watts (H&V)
R = 42.8 meters
F = 0.211 (field factor)

$S = 18.9\ \mu W/cm^2$

KUSM-DT will contribute less than 18.9 $\mu W/cm^2$ at 2 meters above ground.
The limit for an uncontrolled environment is 200 $\mu W/cm^2$ for a station broadcasting on Channel 8, 210 to 216 MHz range.

Therefore:

KUSM-DT DTV facility contributes less than 9.5% RFF for an uncontrolled environment two meters above ground at the tower site.

KBZK DTV Facility

Channel 13	Freq:	210-216 MHz range
	Polarization =	Elliptical

KBZK proposes to utilize a ERI, Type ATW5V5-ETO-13H elliptical antenna with 1.25° electrical beam tilt. In the application for construction permit (0000098115) the applicant states it will have less than 5% of the current radiation limit.

There are no AM towers within 3.2 kilometers of the proposed site. According to the LMS database dated June 18, 2020, there are no full service FM stations broadcasting near the transmitter site for KUSM.

In total, the RFF levels around the base of the tower are not predicted to exceed fifteen percent of the maximum allowed for uncontrolled exposure with all facilities within the study area of the tower with each operating at full power.

Authorized personnel and rigging contractors will be alerted to the potential zone of high field levels on the proposed 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 KUSM-TV 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.

ABOVE MEAN SEA LEVEL

ABOVE GROUND

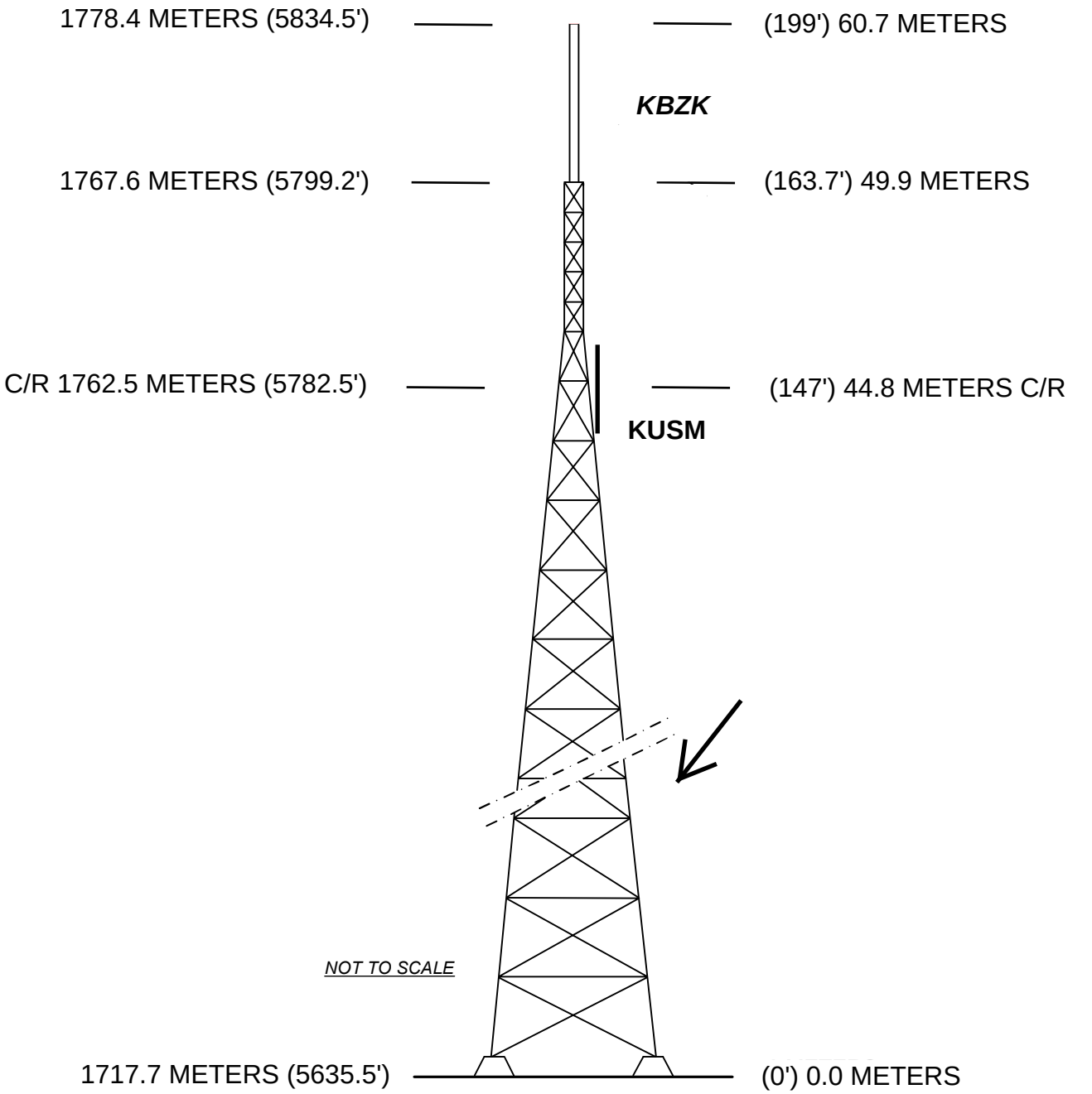


EXHIBIT E-1

PROPOSED TOWER
KUSM, BOZEMAN, MONTANA
JUNE 2020

Cohen, Dippell and Everist, P.C. Consulting Engineers Washington, D.C.

COHEN, DIPPELL AND EVERIST, P.C. Consulting Engineers Washington, D.C.
NORRIS RD
NORRIS RD
CHURCHILL RD
VISSER
HORIZON VW
HIGH FLAT RD
Yellow Dog Cr
84
4900
5000
5100
5200
5300
5400
5500
5600
5700
40'
5056
5055
5054
5053000m N
45°37'30"
111°15'
17'30"
477
478
479
480000m E
NORTH: 45° 38' 15.1"
WEST: 111° 16' 07"
NAD-83
EXHIBIT E-1A
PROPOSED TOWER
KUSM, BOZEMAN, MONTANA
JUNE 2020
ANCENEY, MT
7.5' US TOPO
2017
1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET
CONTOUR INTERVAL 20 FEET

EXHIBIT E-2

ANTENNA MANUFACTURER DATA

ERI #37761

TRASAR® Side Mounted High Band VHF Elliptically Polarized Television Antenna Manual

KUSM, RF Channel 8

Montana State University, Bozeman, MT

January 28, 2020

Antenna Model:
ATW4V5-ESWCX-8H

This manual supersedes Specification Number 20190625-954

Electronics Research, Inc. 7777 Gardner Road Chandler IN 47610-9219 USA
+1 812 925-6000 (tel) +1 812 925-4030 (fax)

ERI #37761
TRASAR® Side Mounted
High Band VHF Elliptically Polarized
Television Antenna Manual

Electrical Characteristics:

Channel:		8	
Frequency:		180 MHz to 186 MHz	
Service:		ATSC	
Azimuth Pattern Number:	Horizontal Polarization	ATW-WCX	
	Vertical Polarization	ATW-WCX-V	
Elevation Pattern Number:	Horizontal Polarization	ATW4V5H	
	Vertical Polarization	ATW4V5H	
Azimuth Directivity:	Horizontal Polarization	1.40	(1.46 dB)
	Vertical Polarization	1.75	(2.43 dB)
Elevation Directivity:	Horizontal Polarization	4.00	(6.02 dBd)
	Vertical Polarization	4.00	(6.02 dBd)
Peak Power Gain:	Horizontal Polarization	4.52	(6.55 dBd)
	Vertical Polarization	1.35	(1.32 dBd)
Gain at Horizontal:	Horizontal Polarization	4.41	(6.44 dBd)
	Vertical Polarization	1.32	(1.21 dBd)
Vertical/Horizontal Ratio:		0.30	
Electrical Beam Tilt:		1.25 Degrees	
Input Power Required:		3.96 kW	(5.98 dBk)
RF Input:		3-1/8-inch EIA, 50 Ω, flanged male	
Input Power Rating (maximum):		33 kW Average Power, 8VSB	
Antenna VSWR (maximum):		1.10 Over 6 MHz Channel	

ERI #37761
TRASAR® Side Mounted
High Band VHF Elliptically Polarized
Television Antenna Manual

Antenna Mechanical Characteristics:

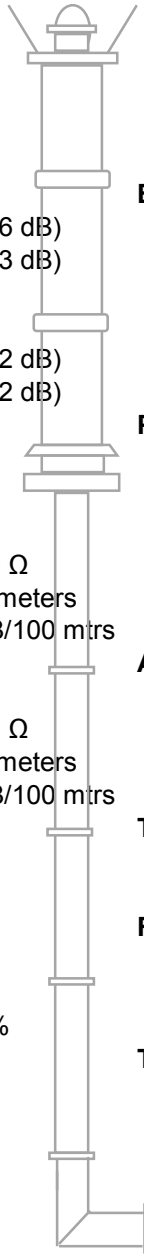
Mounting Configuration:			Side Mounted	
Height of Antenna:			25.60 feet	(7.8 meters)
Height of Center of Radiation:			12.80 feet	(8.9 meters)
Overall Height (Includes two 3.5 ft lightning spurs):			29.10 feet	(3.9 meters)
Deicing:			Fully enclosed pressurized radome	
Radome Diameter (C):			28.50 inches	(723.9 millimeters)
Radome Color:			Aviation Orange	
Climbing Device:			Not Applicable	
Measured Weight:		No Ice	3600.0 lb	1632.9 kg
Windload Data:	EPA	No Ice	37.58 ft²	(3.5 m²)
		1/2" (13 mm) ice	57.32 ft²	(5.3 m²)

Antenna design based on a wind speed of 90 miles per hour (MPH) with no ice and 50 MPH with 0.25-inches of design radial ice (0.74-inches of factored ice at antenna, tiz) with a height above ground level (HAGL) of 142 feet per ANSI/TIA-222-G. Structure Class II, Exposure Category C and Topographic Category 5 with a crest height of 560 feet. Weight and wind area values include two lightning spurs.

NOTE: The purchaser or their representative shall be required to contact the tower owner, state and/or local building officials for specific design requirements and suitable parameters for a particular structure. Any variation from the parameters shown above must be communicated to ERI for comprehensive assessment.

Broadcast Antenna System
Power Analysis

KUSM **RF Channel: 8**
Montana State University
Bozeman, MT
ATW4V5-ESWCX-8H



Antenna Parameters

Azimuth Directivity:

Horizontal:	1.40	(1.46 dB)
Vertical:	1.75	(2.43 dB)

Elevation Directivity:

Horizontal:	4.00	(6.02 dB)
Vertical:	4.00	(6.02 dB)

Transmission Line

Vertical Run:

Type:	3-inch HJ8-50B Air HELIAX, 50 Ω	
Length:	130 feet	39.6 meters
Attenuation:	0.198 dB/100 feet	0.650 dB/100 mtrs

Horizontal Run:

Type:	3-inch HJ8-50B Air HELIAX, 50 Ω	
Length:	50 feet	15.2 meters
Attenuation:	0.198 dB/100 feet	0.650 dB/100 mtrs

Transmission Line Efficiency: 92.11%

RF System/Other Efficiency: 100.00%

Effective Radiated Power:

Horizontal:	17.90 kW	(12.53 dBk)
Vertical:	5.37 kW	(7.30 dBk)

Power Gain:

Horizontal:	4.52 numeric	(6.55 dBd)
Vertical:	1.35 numeric	(1.32 dBd)

Antenna Input Power:
3.96 kW (5.98 dBk)

Transmission Line Losses:
-0.34 kW (0.357 dB)

RF System/Other Losses:
0.00 kW (0.000 dB)

Total Losses:
-0.34 kW (0.357 dB)

Transmitter Power Output:
4.30 kW
(6.34 dBk)

CH.8 BOZEMAN, MT

#37761

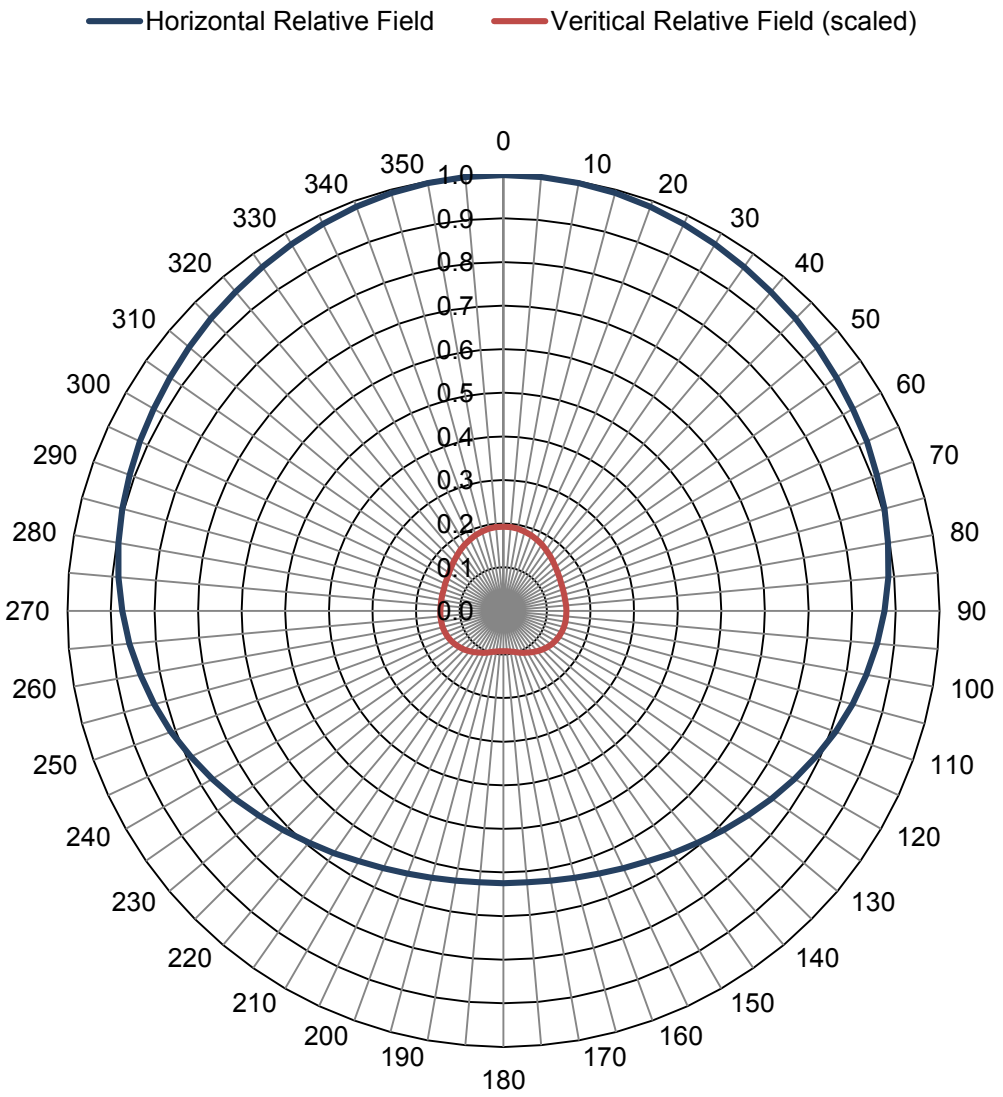
FINAL ANTENNA DATA INCLUDED

LD37761-1	Truck Removal / Lifting Instructions
PM37761-1	Mechanical Parameter / Installation Drawings
37761-A1	Custom Antenna Mount Installation Drawings

Measured VSWR	Frequency (MHz)
1.06	180.00
1.00	181.00
1.05	182.00
1.07	183.00
1.07	184.00
1.02	185.00
1.06	186.00

Composite Azimuth Patterns

Type:	ATW-WCX		**Polarization:**	Elliptical
Directivity (H-Pol):	1.40 numeric	(1.46 dB)	**Frequency:**	8 (ATSC)
Directivity (V-Pol):	1.75 numeric	(2.43 dB)	**Location:**	Bozeman, MT
Percent Horizontal:	80.65%		NOTE: Pattern shape and directivity may vary with channel and mounting	
Percent Vertical:	19.35%			
Power Ratio:	24.00%			

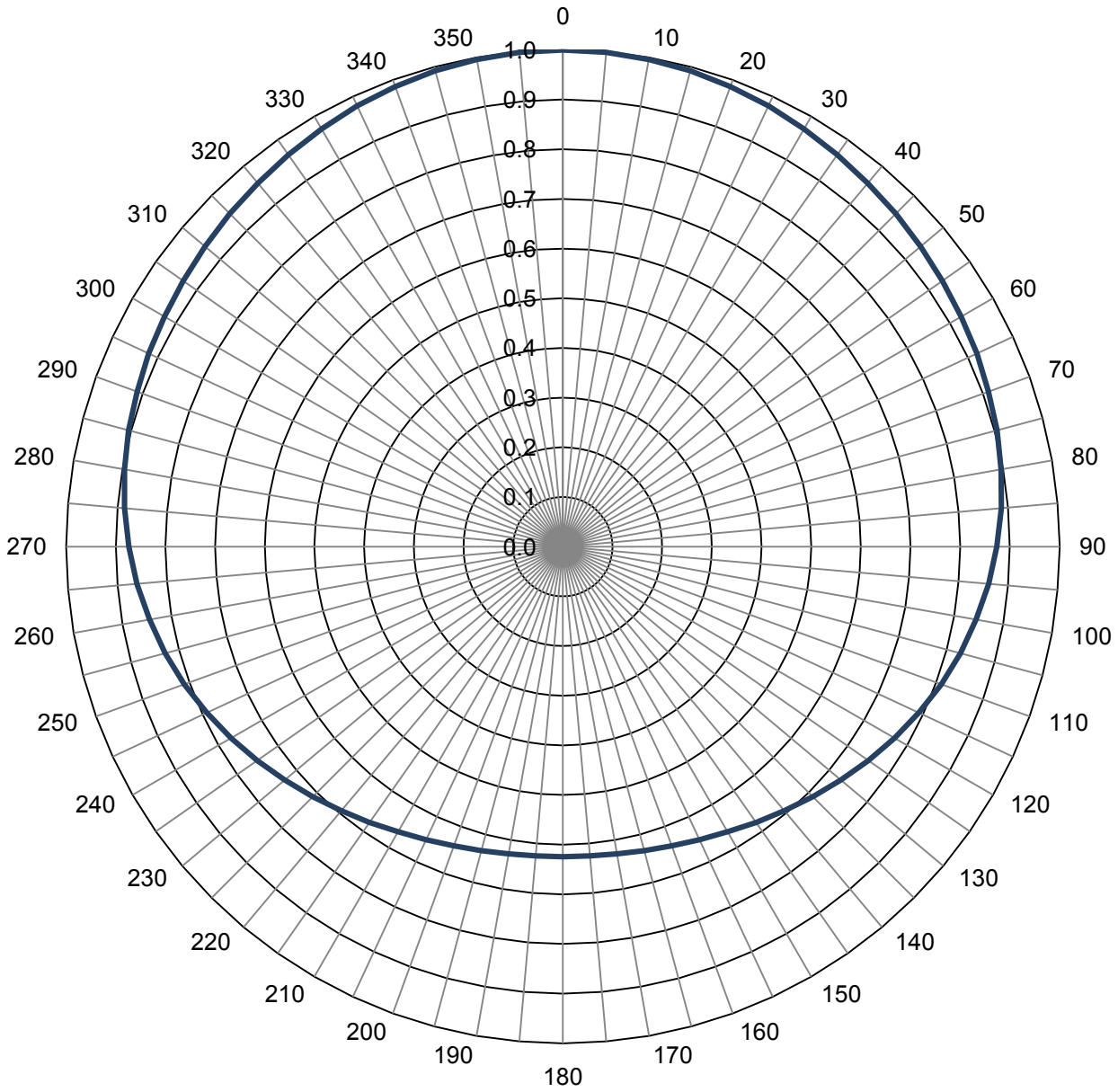


Azimuth Pattern

Type:	ATW-WCX		**Polarization:**	Horizontal
Directivity:	1.40 numeric	(1.46 dB)	**Frequency:**	8 (ATSC)
Peak(s) at:			**Location:**	Bozeman, MT

NOTE: Pattern shape and directivity may vary with channel and mounting configuration.

Relative Field



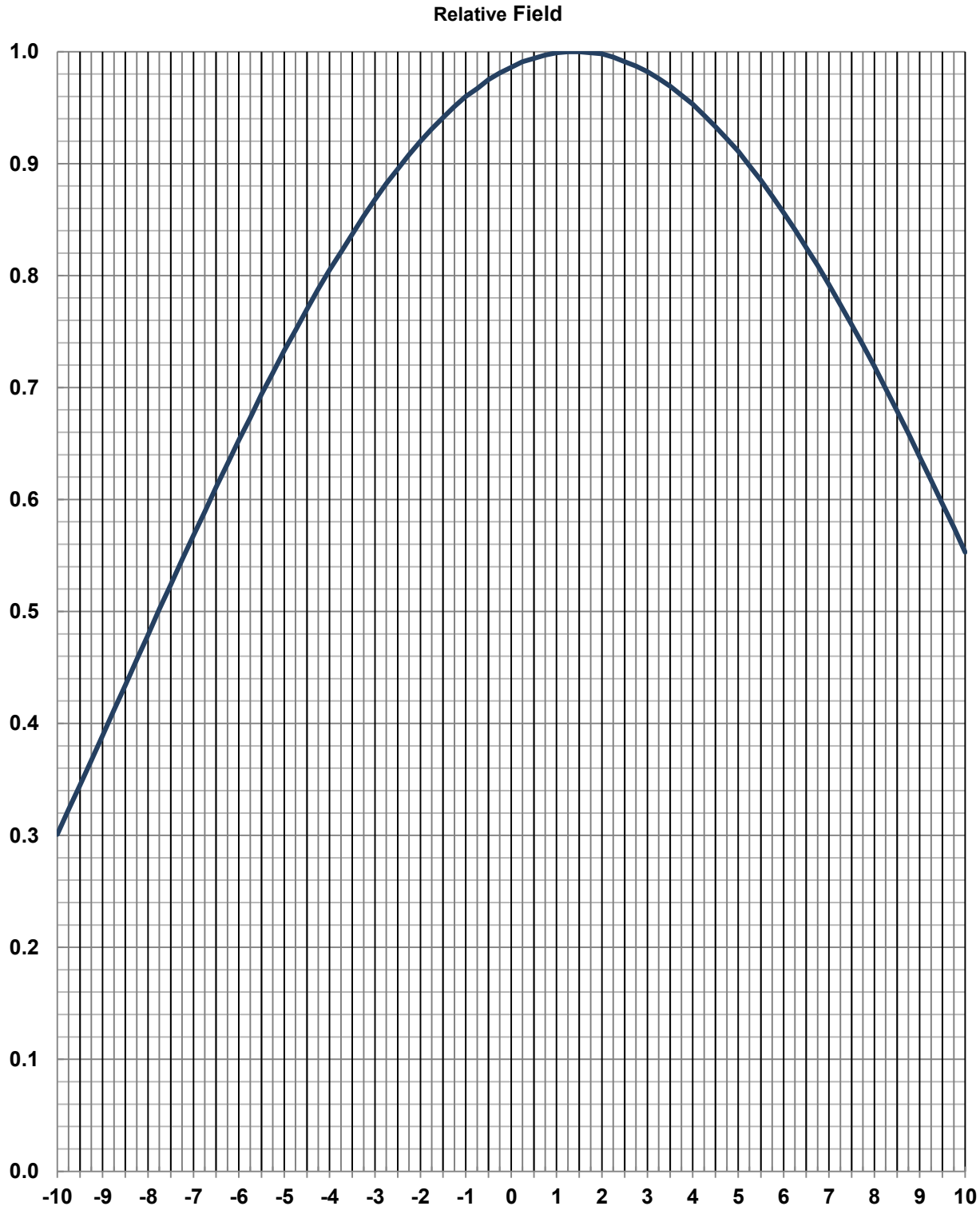
Tabulated Data for Azimuth Pattern

Type: ATW-WCX

Angle	Field	dB
0	1.000	0.00
2	1.000	0.00
4	0.999	-0.01
6	0.999	-0.01
8	0.998	-0.02
10	0.996	-0.03
12	0.995	-0.04
14	0.993	-0.06
16	0.991	-0.08
18	0.988	-0.10
20	0.986	-0.12
22	0.983	-0.15
24	0.980	-0.18
26	0.977	-0.20
28	0.974	-0.23
30	0.971	-0.26
32	0.968	-0.28
34	0.965	-0.31
36	0.962	-0.34
38	0.959	-0.36
40	0.955	-0.40
42	0.952	-0.43
44	0.949	-0.45
46	0.946	-0.48
48	0.943	-0.51
50	0.940	-0.54
52	0.937	-0.57
54	0.935	-0.58
56	0.932	-0.61
58	0.929	-0.64
60	0.926	-0.67
62	0.924	-0.69
64	0.921	-0.71
66	0.918	-0.74
68	0.915	-0.77
70	0.912	-0.80
72	0.909	-0.83
74	0.906	-0.86
76	0.903	-0.89
78	0.899	-0.92
80	0.896	-0.95
82	0.892	-0.99
84	0.888	-1.03
86	0.883	-1.08
88	0.879	-1.12
90	0.874	-1.17
92	0.869	-1.22
94	0.863	-1.28
96	0.858	-1.33
98	0.852	-1.39
100	0.845	-1.46
102	0.839	-1.52
104	0.832	-1.60
106	0.825	-1.67
108	0.818	-1.74
110	0.811	-1.82
112	0.803	-1.91
114	0.795	-1.99
116	0.787	-2.08
118	0.779	-2.17
120	0.771	-2.26
122	0.763	-2.35
124	0.755	-2.44
126	0.747	-2.53
128	0.739	-2.63
130	0.731	-2.72
132	0.724	-2.81
134	0.716	-2.90
136	0.708	-3.00
138	0.701	-3.09
140	0.694	-3.17
142	0.687	-3.26
144	0.681	-3.34
146	0.675	-3.41
148	0.669	-3.49
150	0.663	-3.57
152	0.658	-3.64
154	0.654	-3.69
156	0.649	-3.76
158	0.645	-3.81
160	0.641	-3.86
162	0.638	-3.90
164	0.635	-3.94
166	0.632	-3.99
168	0.630	-4.01
170	0.628	-4.04
172	0.627	-4.05
174	0.626	-4.07
176	0.625	-4.08
178	0.624	-4.10
180	0.624	-4.10
182	0.624	-4.10
184	0.625	-4.08
186	0.626	-4.07
188	0.627	-4.05
190	0.628	-4.04
192	0.630	-4.01
194	0.632	-3.99
196	0.635	-3.94
198	0.638	-3.90
200	0.641	-3.86
202	0.645	-3.81
204	0.649	-3.76
206	0.654	-3.69
208	0.658	-3.64
210	0.663	-3.57
212	0.669	-3.49
214	0.675	-3.41
216	0.681	-3.34
218	0.687	-3.26
220	0.694	-3.17
222	0.701	-3.09
224	0.708	-3.00
226	0.716	-2.90
228	0.724	-2.81
230	0.731	-2.72
232	0.739	-2.63
234	0.747	-2.53
236	0.755	-2.44
238	0.763	-2.35
240	0.771	-2.26
242	0.779	-2.17
244	0.787	-2.08
246	0.795	-1.99
248	0.803	-1.91
250	0.811	-1.82
252	0.818	-1.74
254	0.825	-1.67
256	0.832	-1.60
258	0.839	-1.52
260	0.845	-1.46
262	0.852	-1.39
264	0.858	-1.33
266	0.863	-1.28
268	0.869	-1.22
270	0.874	-1.17
272	0.879	-1.12
274	0.883	-1.08
276	0.888	-1.03
278	0.892	-0.99
280	0.896	-0.95
282	0.899	-0.92
284	0.903	-0.89
286	0.906	-0.86
288	0.909	-0.83
290	0.912	-0.80
292	0.915	-0.77
294	0.918	-0.74
296	0.921	-0.71
298	0.924	-0.69
300	0.926	-0.67
302	0.929	-0.64
304	0.932	-0.61
306	0.935	-0.58
308	0.937	-0.57
310	0.940	-0.54
312	0.943	-0.51
314	0.946	-0.48
316	0.949	-0.45
318	0.952	-0.43
320	0.955	-0.40
322	0.959	-0.36
324	0.962	-0.34
326	0.965	-0.31
328	0.968	-0.28
330	0.971	-0.26
332	0.974	-0.23
334	0.977	-0.20
336	0.980	-0.18
338	0.983	-0.15
340	0.986	-0.12
342	0.988	-0.10
344	0.991	-0.08
346	0.993	-0.06
348	0.995	-0.04
350	0.996	-0.03
352	0.998	-0.02
354	0.999	-0.01
356	0.999	-0.01
358	1.000	0.00
360	1.000	0.00

Elevation Pattern

Type:	ATW4V5H		**Polarization:**	Horizontal
Directivity:			**Frequency:**	8 (ATSC)
Main Lobe:	4.00 numeric	(6.02 dB)	**Location:**	Bozeman, MT
Horizontal:	3.90 numeric	(5.92 dB)	**Beam Tilt:**	1.25 degrees



Tabulated Data for Elevation Pattern

Type: ATW4V5H

-10 to 10 degrees in 0.25 degree increments.
10 to 90 degrees in 0.50 degree increments.

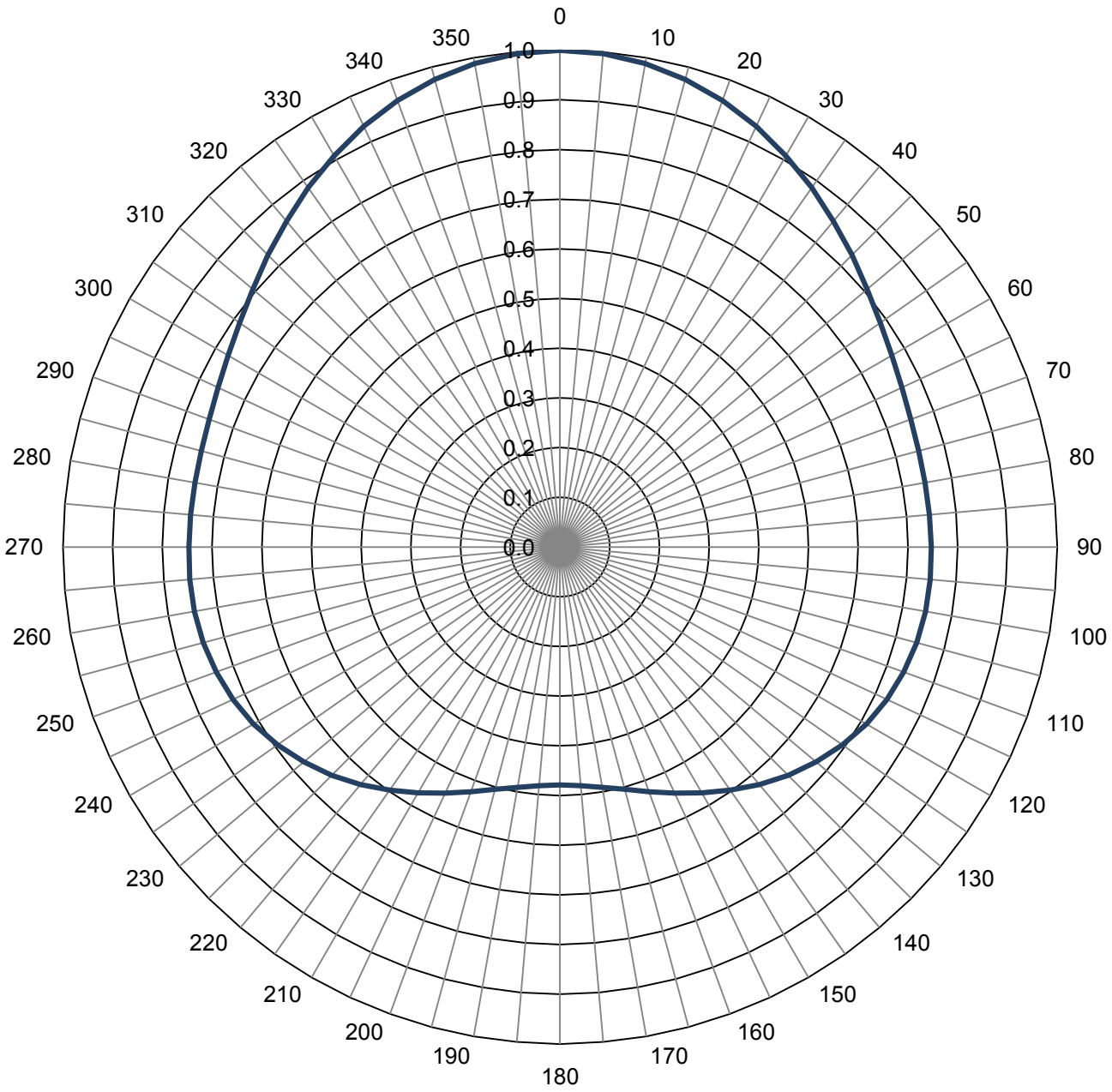
Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB
-10.00	0.301	-10.43	2.25	0.995	-0.04	19.00	0.138	-17.20	43.50	0.174	-15.19	68.00	0.191	-14.38
-9.75	0.323	-9.82	2.50	0.991	-0.08	19.50	0.159	-15.97	44.00	0.172	-15.29	68.50	0.191	-14.38
-9.50	0.345	-9.24	2.75	0.987	-0.11	20.00	0.177	-15.04	44.50	0.168	-15.49	69.00	0.191	-14.38
-9.25	0.367	-8.71	3.00	0.982	-0.16	20.50	0.193	-14.29	45.00	0.164	-15.70	69.50	0.190	-14.42
-9.00	0.389	-8.20	3.25	0.976	-0.21	21.00	0.207	-13.68	45.50	0.159	-15.97	70.00	0.189	-14.47
-8.75	0.412	-7.70	3.50	0.969	-0.27	21.50	0.218	-13.23	46.00	0.153	-16.31	70.50	0.188	-14.52
-8.50	0.434	-7.25	3.75	0.961	-0.35	22.00	0.227	-12.88	46.50	0.147	-16.65	71.00	0.186	-14.61
-8.25	0.457	-6.80	4.00	0.953	-0.42	22.50	0.234	-12.62	47.00	0.140	-17.08	71.50	0.185	-14.66
-8.00	0.479	-6.39	4.25	0.943	-0.51	23.00	0.238	-12.47	47.50	0.132	-17.59	72.00	0.182	-14.80
-7.75	0.502	-5.99	4.50	0.933	-0.60	23.50	0.239	-12.43	48.00	0.124	-18.13	72.50	0.180	-14.89
-7.50	0.524	-5.61	4.75	0.922	-0.71	24.00	0.239	-12.43	48.50	0.116	-18.71	73.00	0.177	-15.04
-7.25	0.546	-5.26	5.00	0.911	-0.81	24.50	0.237	-12.51	49.00	0.107	-19.41	73.50	0.174	-15.19
-7.00	0.568	-4.91	5.25	0.898	-0.93	25.00	0.232	-12.69	49.50	0.098	-20.18	74.00	0.171	-15.34
-6.75	0.589	-4.60	5.50	0.885	-1.06	25.50	0.226	-12.92	50.00	0.089	-21.01	74.50	0.168	-15.49
-6.50	0.611	-4.28	5.75	0.871	-1.20	26.00	0.218	-13.23	50.50	0.081	-21.83	75.00	0.164	-15.70
-6.25	0.632	-3.99	6.00	0.856	-1.35	26.50	0.209	-13.60	51.00	0.072	-22.85	75.50	0.160	-15.92
-6.00	0.653	-3.70	6.25	0.841	-1.50	27.00	0.198	-14.07	51.50	0.065	-23.74	76.00	0.156	-16.14
-5.75	0.673	-3.44	6.50	0.825	-1.67	27.50	0.185	-14.66	52.00	0.058	-24.73	76.50	0.152	-16.36
-5.50	0.694	-3.17	6.75	0.809	-1.84	28.00	0.172	-15.29	52.50	0.053	-25.51	77.00	0.148	-16.59
-5.25	0.713	-2.94	7.00	0.792	-2.03	28.50	0.157	-16.08	53.00	0.049	-26.20	77.50	0.143	-16.89
-5.00	0.733	-2.70	7.25	0.774	-2.23	29.00	0.142	-16.95	53.50	0.048	-26.38	78.00	0.139	-17.14
-4.75	0.751	-2.49	7.50	0.756	-2.43	29.50	0.126	-17.99	54.00	0.050	-26.02	78.50	0.134	-17.46
-4.50	0.770	-2.27	7.75	0.738	-2.64	30.00	0.109	-19.25	54.50	0.054	-25.35	79.00	0.129	-17.79
-4.25	0.788	-2.07	8.00	0.719	-2.87	30.50	0.092	-20.72	55.00	0.059	-24.58	79.50	0.124	-18.13
-4.00	0.805	-1.88	8.25	0.699	-3.11	31.00	0.074	-22.62	55.50	0.066	-23.61	80.00	0.118	-18.56
-3.75	0.821	-1.71	8.50	0.679	-3.36	31.50	0.057	-24.88	56.00	0.073	-22.73	80.50	0.113	-18.94
-3.50	0.837	-1.55	8.75	0.659	-3.62	32.00	0.039	-28.18	56.50	0.081	-21.83	81.00	0.108	-19.33
-3.25	0.853	-1.38	9.00	0.638	-3.90	32.50	0.022	-33.15	57.00	0.089	-21.01	81.50	0.102	-19.83
-3.00	0.868	-1.23	9.25	0.617	-4.19	33.00	0.006	-44.44	57.50	0.097	-20.26	82.00	0.097	-20.26
-2.75	0.882	-1.09	9.50	0.596	-4.50	33.50	0.014	-37.08	58.00	0.104	-19.66	82.50	0.091	-20.82
-2.50	0.895	-0.96	9.75	0.575	-4.81	34.00	0.030	-30.46	58.50	0.112	-19.02	83.00	0.085	-21.41
-2.25	0.908	-0.84	10.00	0.553	-5.15	34.50	0.046	-26.74	59.00	0.120	-18.42	83.50	0.079	-22.05
-2.00	0.920	-0.72	10.50	0.509	-5.87	35.00	0.061	-24.29	59.50	0.127	-17.92	84.00	0.073	-22.73
-1.75	0.931	-0.62	11.00	0.464	-6.67	35.50	0.076	-22.38	60.00	0.134	-17.46	84.50	0.067	-23.48
-1.50	0.941	-0.53	11.50	0.420	-7.54	36.00	0.089	-21.01	60.50	0.140	-17.08	85.00	0.061	-24.29
-1.25	0.951	-0.44	12.00	0.375	-8.52	36.50	0.102	-19.83	61.00	0.147	-16.65	85.50	0.055	-25.19
-1.00	0.960	-0.35	12.50	0.331	-9.60	37.00	0.114	-18.86	61.50	0.152	-16.36	86.00	0.049	-26.20
-0.75	0.967	-0.29	13.00	0.287	-10.84	37.50	0.125	-18.06	62.00	0.158	-16.03	86.50	0.043	-27.33
-0.50	0.975	-0.22	13.50	0.244	-12.25	38.00	0.135	-17.39	62.50	0.163	-15.76	87.00	0.037	-28.64
-0.25	0.981	-0.17	14.00	0.202	-13.89	38.50	0.144	-16.83	63.00	0.168	-15.49	87.50	0.031	-30.17
0.00	0.986	-0.12	14.50	0.161	-15.86	39.00	0.152	-16.36	63.50	0.172	-15.29	88.00	0.025	-32.04
0.25	0.991	-0.08	15.00	0.122	-18.27	39.50	0.159	-15.97	64.00	0.175	-15.14	88.50	0.019	-34.42
0.50	0.994	-0.05	15.50	0.086	-21.31	40.00	0.165	-15.65	64.50	0.179	-14.94	89.00	0.012	-38.42
0.75	0.997	-0.03	16.00	0.054	-25.35	40.50	0.169	-15.44	65.00	0.182	-14.80	89.50	0.006	-44.44
1.00	0.999	-0.01	16.50	0.034	-29.37	41.00	0.173	-15.24	65.50	0.184	-14.70	90.00	0.000	---
1.25	1.000	0.00	17.00	0.042	-27.54	41.50	0.175	-15.14	66.00	0.186	-14.61			
1.50	1.000	0.00	17.50	0.065	-23.74	42.00	0.177	-15.04	66.50	0.188	-14.52			
1.75	0.999	-0.01	18.00	0.090	-20.92	42.50	0.177	-15.04	67.00	0.189	-14.47			
2.00	0.998	-0.02	18.50	0.115	-18.79	43.00	0.176	-15.09	67.50	0.190	-14.42			

Azimuth Pattern

Type:	ATW-WCX-V		**Polarization:**	Vertical
Directivity:	1.75 numeric	(2.43 dB)	**Frequency:**	8 (ATSC)
Peak(s) at:			**Location:**	Bozeman, MT

NOTE: Pattern shape and directivity may vary with channel and mounting configuration.

Relative Field



Tabulated Data for Azimuth Pattern

Type: ATW-WCX-V

Angle	Field	dB
0	1.000	0.00
2	1.000	0.00
4	0.998	-0.02
6	0.996	-0.03
8	0.993	-0.06
10	0.988	-0.10
12	0.983	-0.15
14	0.978	-0.19
16	0.971	-0.26
18	0.964	-0.32
20	0.956	-0.39
22	0.947	-0.47
24	0.938	-0.56
26	0.929	-0.64
28	0.919	-0.73
30	0.909	-0.83
32	0.898	-0.93
34	0.888	-1.03
36	0.877	-1.14
38	0.867	-1.24
40	0.856	-1.35
42	0.846	-1.45
44	0.836	-1.56
46	0.826	-1.66
48	0.816	-1.77
50	0.807	-1.86
52	0.799	-1.95
54	0.791	-2.04
56	0.784	-2.11
58	0.777	-2.19
60	0.771	-2.26
62	0.766	-2.32
64	0.761	-2.37
66	0.757	-2.42
68	0.754	-2.45
70	0.751	-2.49
72	0.749	-2.51
74	0.748	-2.52
76	0.747	-2.53
78	0.746	-2.55
80	0.746	-2.55
82	0.746	-2.55
84	0.746	-2.55
86	0.746	-2.55
88	0.747	-2.53
90	0.747	-2.53
92	0.747	-2.53
94	0.748	-2.52
96	0.748	-2.52
98	0.747	-2.53

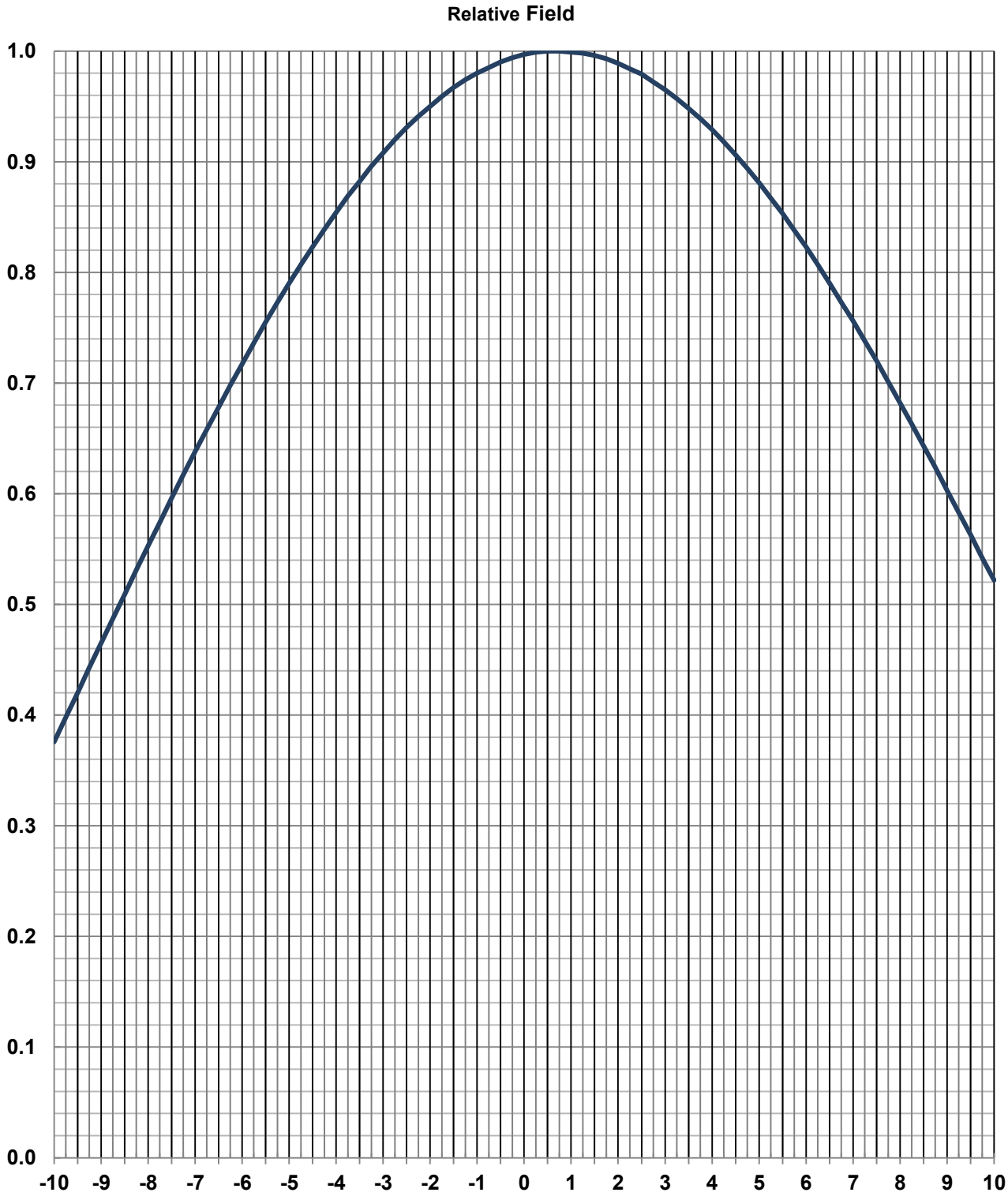
Angle	Field	dB
100	0.747	-2.53
102	0.746	-2.55
104	0.744	-2.57
106	0.742	-2.59
108	0.739	-2.63
110	0.736	-2.66
112	0.733	-2.70
114	0.728	-2.76
116	0.724	-2.81
118	0.718	-2.88
120	0.712	-2.95
122	0.705	-3.04
124	0.698	-3.12
126	0.690	-3.22
128	0.682	-3.32
130	0.673	-3.44
132	0.664	-3.56
134	0.654	-3.69
136	0.645	-3.81
138	0.634	-3.96
140	0.624	-4.10
142	0.613	-4.25
144	0.603	-4.39
146	0.592	-4.55
148	0.581	-4.72
150	0.571	-4.87
152	0.561	-5.02
154	0.551	-5.18
156	0.541	-5.34
158	0.532	-5.48
160	0.524	-5.61
162	0.516	-5.75
164	0.508	-5.88
166	0.502	-5.99
168	0.496	-6.09
170	0.491	-6.18
172	0.487	-6.25
174	0.483	-6.32
176	0.481	-6.36
178	0.480	-6.38
180	0.479	-6.39
182	0.480	-6.38
184	0.481	-6.36
186	0.483	-6.32
188	0.487	-6.25
190	0.491	-6.18
192	0.496	-6.09
194	0.502	-5.99
196	0.508	-5.88
198	0.516	-5.75

Angle	Field	dB
200	0.524	-5.61
202	0.532	-5.48
204	0.541	-5.34
206	0.551	-5.18
208	0.561	-5.02
210	0.571	-4.87
212	0.581	-4.72
214	0.592	-4.55
216	0.603	-4.39
218	0.613	-4.25
220	0.624	-4.10
222	0.634	-3.96
224	0.645	-3.81
226	0.654	-3.69
228	0.664	-3.56
230	0.673	-3.44
232	0.682	-3.32
234	0.690	-3.22
236	0.698	-3.12
238	0.705	-3.04
240	0.712	-2.95
242	0.718	-2.88
244	0.724	-2.81
246	0.728	-2.76
248	0.733	-2.70
250	0.736	-2.66
252	0.739	-2.63
254	0.742	-2.59
256	0.744	-2.57
258	0.746	-2.55
260	0.747	-2.53
262	0.747	-2.53
264	0.748	-2.52
266	0.748	-2.52
268	0.747	-2.53
270	0.747	-2.53
272	0.747	-2.53
274	0.746	-2.55
276	0.746	-2.55
278	0.746	-2.55
280	0.746	-2.55
282	0.746	-2.55
284	0.747	-2.53
286	0.748	-2.52
288	0.749	-2.51
290	0.751	-2.49
292	0.754	-2.45
294	0.757	-2.42
296	0.761	-2.37
298	0.766	-2.32

Angle	Field	dB
300	0.771	-2.26
302	0.777	-2.19
304	0.784	-2.11
306	0.791	-2.04
308	0.799	-1.95
310	0.807	-1.86
312	0.816	-1.77
314	0.826	-1.66
316	0.836	-1.56
318	0.846	-1.45
320	0.856	-1.35
322	0.867	-1.24
324	0.877	-1.14
326	0.888	-1.03
328	0.898	-0.93
330	0.909	-0.83
332	0.919	-0.73
334	0.929	-0.64
336	0.938	-0.56
338	0.947	-0.47
340	0.956	-0.39
342	0.964	-0.32
344	0.971	-0.26
346	0.978	-0.19
348	0.983	-0.15
350	0.988	-0.10
352	0.993	-0.06
354	0.996	-0.03
356	0.998	-0.02
358	1.000	0.00
360	1.000	0.00

Elevation Pattern

Type:	ATW4V5H		**Polarization:**	Vertical
Directivity:			**Frequency:**	8 (ATSC)
Main Lobe:	4.00 numeric	(6.02 dB)	**Location:**	Bozeman, MT
Horizontal:	3.90 numeric	(5.92 dB)	**Beam Tilt:**	1.25 degrees



Tabulated Data for Elevation Pattern

Type: ATW4V5H

-10 to 10 degrees in 0.25 degree increments.
10 to 90 degrees in 0.50 degree increments.

Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB	Angle	Field	dB
-10.00	0.376	-8.50	2.25	0.984	-0.14	19.00	0.151	-16.42	43.50	0.166	-15.60	68.00	0.211	-13.51
-9.75	0.398	-8.00	2.50	0.979	-0.18	19.50	0.163	-15.76	44.00	0.160	-15.92	68.50	0.210	-13.56
-9.50	0.420	-7.54	2.75	0.972	-0.25	20.00	0.173	-15.24	44.50	0.153	-16.31	69.00	0.209	-13.60
-9.25	0.443	-7.07	3.00	0.965	-0.31	20.50	0.181	-14.85	45.00	0.146	-16.71	69.50	0.208	-13.64
-9.00	0.465	-6.65	3.25	0.957	-0.38	21.00	0.188	-14.52	45.50	0.137	-17.27	70.00	0.206	-13.72
-8.75	0.487	-6.25	3.50	0.948	-0.46	21.50	0.194	-14.24	46.00	0.128	-17.86	70.50	0.204	-13.81
-8.50	0.509	-5.87	3.75	0.939	-0.55	22.00	0.197	-14.11	46.50	0.119	-18.49	71.00	0.202	-13.89
-8.25	0.531	-5.50	4.00	0.929	-0.64	22.50	0.199	-14.02	47.00	0.109	-19.25	71.50	0.200	-13.98
-8.00	0.553	-5.15	4.25	0.918	-0.74	23.00	0.199	-14.02	47.50	0.098	-20.18	72.00	0.197	-14.11
-7.75	0.574	-4.82	4.50	0.906	-0.86	23.50	0.197	-14.11	48.00	0.088	-21.11	72.50	0.194	-14.24
-7.50	0.596	-4.50	4.75	0.894	-0.97	24.00	0.193	-14.29	48.50	0.076	-22.38	73.00	0.190	-14.42
-7.25	0.617	-4.19	5.00	0.881	-1.10	24.50	0.188	-14.52	49.00	0.065	-23.74	73.50	0.187	-14.56
-7.00	0.638	-3.90	5.25	0.867	-1.24	25.00	0.181	-14.85	49.50	0.054	-25.35	74.00	0.183	-14.75
-6.75	0.658	-3.64	5.50	0.853	-1.38	25.50	0.173	-15.24	50.00	0.042	-27.54	74.50	0.179	-14.94
-6.50	0.678	-3.38	5.75	0.838	-1.54	26.00	0.164	-15.70	50.50	0.030	-30.46	75.00	0.175	-15.14
-6.25	0.698	-3.12	6.00	0.823	-1.69	26.50	0.154	-16.25	51.00	0.019	-34.42	75.50	0.170	-15.39
-6.00	0.717	-2.89	6.25	0.807	-1.86	27.00	0.143	-16.89	51.50	0.009	-40.92	76.00	0.166	-15.60
-5.75	0.736	-2.66	6.50	0.790	-2.05	27.50	0.131	-17.65	52.00	0.010	-40.00	76.50	0.161	-15.86
-5.50	0.755	-2.44	6.75	0.773	-2.24	28.00	0.119	-18.49	52.50	0.020	-33.98	77.00	0.156	-16.14
-5.25	0.773	-2.24	7.00	0.756	-2.43	28.50	0.107	-19.41	53.00	0.031	-30.17	77.50	0.151	-16.42
-5.00	0.790	-2.05	7.25	0.738	-2.64	29.00	0.096	-20.35	53.50	0.043	-27.33	78.00	0.146	-16.71
-4.75	0.807	-1.86	7.50	0.720	-2.85	29.50	0.085	-21.41	54.00	0.054	-25.35	78.50	0.141	-17.02
-4.50	0.823	-1.69	7.75	0.701	-3.09	30.00	0.076	-22.38	54.50	0.065	-23.74	79.00	0.135	-17.39
-4.25	0.839	-1.52	8.00	0.682	-3.32	30.50	0.070	-23.10	55.00	0.076	-22.38	79.50	0.130	-17.72
-4.00	0.854	-1.37	8.25	0.663	-3.57	31.00	0.067	-23.48	55.50	0.086	-21.31	80.00	0.124	-18.13
-3.75	0.869	-1.22	8.50	0.643	-3.84	31.50	0.067	-23.48	56.00	0.097	-20.26	80.50	0.118	-18.56
-3.50	0.882	-1.09	8.75	0.624	-4.10	32.00	0.071	-22.97	56.50	0.106	-19.49	81.00	0.113	-18.94
-3.25	0.896	-0.95	9.00	0.603	-4.39	32.50	0.078	-22.16	57.00	0.116	-18.71	81.50	0.107	-19.41
-3.00	0.908	-0.84	9.25	0.583	-4.69	33.00	0.086	-21.31	57.50	0.125	-18.06	82.00	0.101	-19.91
-2.75	0.920	-0.72	9.50	0.563	-4.99	33.50	0.096	-20.35	58.00	0.134	-17.46	82.50	0.095	-20.45
-2.50	0.931	-0.62	9.75	0.542	-5.32	34.00	0.106	-19.49	58.50	0.142	-16.95	83.00	0.089	-21.01
-2.25	0.941	-0.53	10.00	0.522	-5.65	34.50	0.116	-18.71	59.00	0.150	-16.48	83.50	0.083	-21.62
-2.00	0.950	-0.45	10.50	0.481	-6.36	35.00	0.126	-17.99	59.50	0.157	-16.08	84.00	0.076	-22.38
-1.75	0.959	-0.36	11.00	0.440	-7.13	35.50	0.136	-17.33	60.00	0.164	-15.70	84.50	0.070	-23.10
-1.50	0.967	-0.29	11.50	0.399	-7.98	36.00	0.145	-16.77	60.50	0.170	-15.39	85.00	0.064	-23.88
-1.25	0.974	-0.23	12.00	0.359	-8.90	36.50	0.153	-16.31	61.00	0.176	-15.09	85.50	0.058	-24.73
-1.00	0.980	-0.18	12.50	0.320	-9.90	37.00	0.161	-15.86	61.50	0.182	-14.80	86.00	0.051	-25.85
-0.75	0.985	-0.13	13.00	0.283	-10.96	37.50	0.167	-15.55	62.00	0.186	-14.61	86.50	0.045	-26.94
-0.50	0.990	-0.09	13.50	0.247	-12.15	38.00	0.172	-15.29	62.50	0.191	-14.38	87.00	0.039	-28.18
-0.25	0.994	-0.05	14.00	0.214	-13.39	38.50	0.177	-15.04	63.00	0.195	-14.20	87.50	0.032	-29.90
0.00	0.997	-0.03	14.50	0.183	-14.75	39.00	0.180	-14.89	63.50	0.199	-14.02	88.00	0.026	-31.70
0.25	0.999	-0.01	15.00	0.157	-16.08	39.50	0.183	-14.75	64.00	0.202	-13.89	88.50	0.019	-34.42
0.50	1.000	0.00	15.50	0.136	-17.33	40.00	0.184	-14.70	64.50	0.204	-13.81	89.00	0.013	-37.72
0.75	1.000	0.00	16.00	0.121	-18.34	40.50	0.185	-14.66	65.00	0.207	-13.68	89.50	0.006	-44.44
1.00	0.999	-0.01	16.50	0.114	-18.86	41.00	0.184	-14.70	65.50	0.208	-13.64	90.00	0.000	---
1.25	0.998	-0.02	17.00	0.113	-18.94	41.50	0.182	-14.80	66.00	0.210	-13.56			
1.50	0.996	-0.03	17.50	0.119	-18.49	42.00	0.180	-14.89	66.50	0.211	-13.51			
1.75	0.993	-0.06	18.00	0.128	-17.86	42.50	0.176	-15.09	67.00	0.211	-13.51			
2.00	0.989	-0.10	18.50	0.140	-17.08	43.00	0.172	-15.29	67.50	0.211	-13.51			

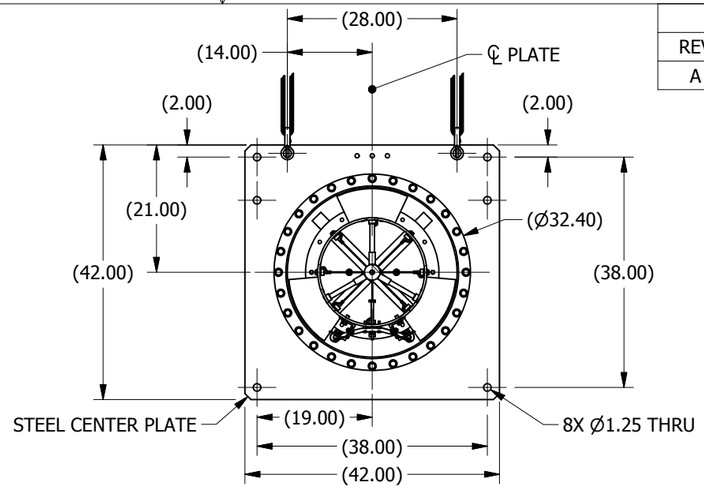
FIGURE #1
REMOVAL FROM TRUCK

LIFT ANTENNA FROM TRUCK BED USING ANTENNA PLATES, NOT THE RADOMES, AT THE LOCATIONS INDICATED. TO PREVENT ROLLING, LIFT FROM THE PLATES AS SHOWN IN VIEW "X-X". DO NOT LIFT ANTENNA BY FIBERGLASS RADOMES, **DAMAGE WILL OCCUR**.

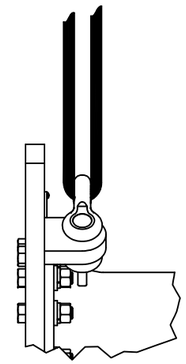
NOTES:

1. THE LIFTING DETAILS PROVIDED IDENTIFY THE PRIMARY RIGGING ATTACHMENT POINTS ON THE ANTENNA FOR DELIVERY LOADING/UNLOADING, UPENDING, AND HOISTING OPERATIONS.
2. ALL RIGGING COMPONENTS SHALL BE PROPERLY SELECTED AND SIZED BY THE CONTRACTOR'S QUALIFIED PERSON TO ENSURE THE COMPONENTS ARE UTILIZED IN ACCORDANCE WITH RIGGING MANUFACTURER'S WLL LIMITS AND ASSOCIATED SPECIFICATIONS.
3. CONTACT ERI FOR REVIEW AND APPROVAL IF ALTERNATE RIGGING ATTACHMENT POINTS ARE NEEDED FOR HANDLING OR HOISTING OPERATIONS.

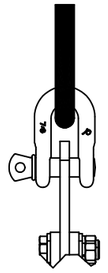
REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED
A	ADDED FINAL DATA	1/28/2020	K. SCHARP



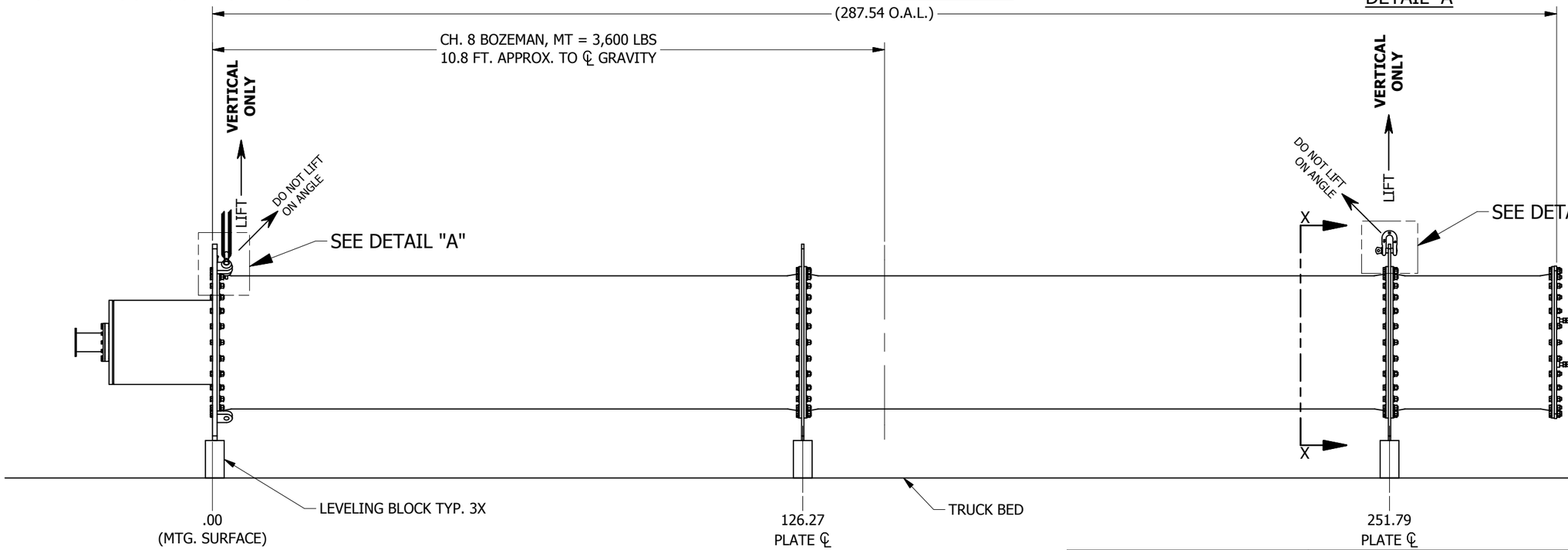
SECTION X-X



DETAIL A



DETAIL B



PROJECT NO.	37761/1	
ERI APPROVAL	NAME	DATE
DRAWN BY	LMJ	12/2/2019
DRAFTING	GAG	12/3/2019
DESIGN MGR.	K.SCHARP	12/3/2019
ENG.		
MANUF.		
EXT. APPROVAL		
SUPERSEDES PART NO.		
FILE NAME: LD37761-1.idw		

ELECTRONICS RESEARCH INC.
ESTABLISHED 1943
7777 GARDNER Rd.
CHANDLER, IN
47610-9219
PHONE: (812) 925-6000
FAX: (812) 925-4030

TITLE:
LIFTING DETAILS
37761 - BOZEMAN, MT - CH. 8

SIZE	CAGE CODE	DWG NO.	REV.
B	OZNS1	LD37761-1	A
SCALE : 1 / 25	WEIGHT: N/A	SHEET: 1 OF 4	

AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

MATERIAL

FINISH

TOLERANCES
OVERALL-NOT CUMULATIVE
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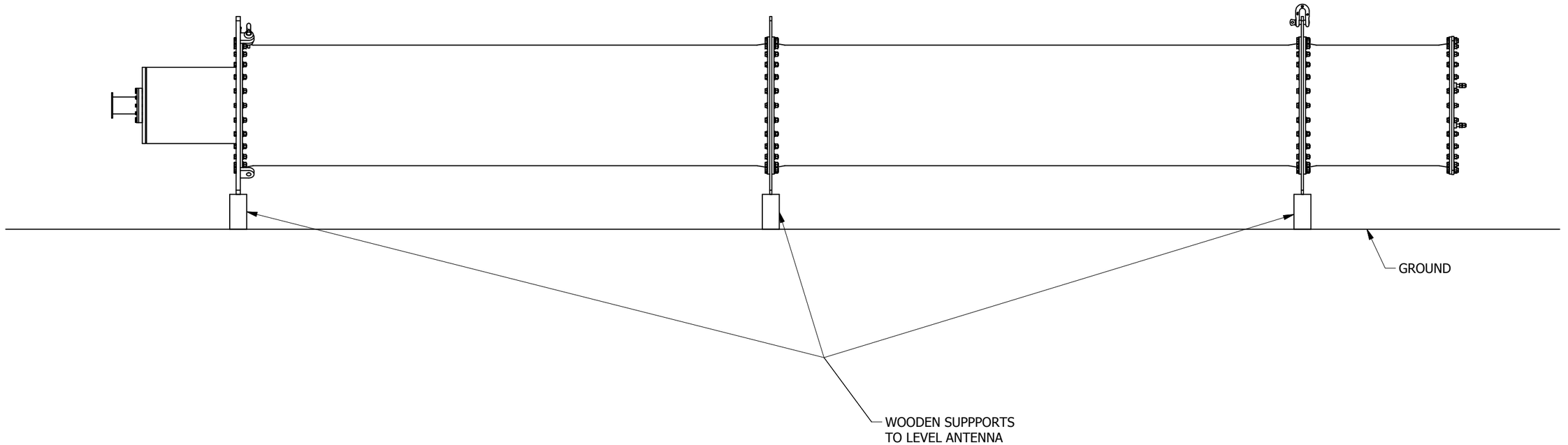
1 PLACE DECIMAL ± .1
2 PLACE DECIMAL ± .03
3 PLACE DECIMAL ± .010
ANGULAR ± .5°
FRACTIONAL ± 1/16"

FIGURE #2

PLACE ALL ANTENNA RADOME JOINTS WITH THE STEEL CENTER PLATES ON WOODEN SUPPORTS AS SHOWN. ANTENNA SHOULD BE LEVEL TO PREVENT DAMAGE. USE SUPPORTS HIGH ENOUGH TO AVOID DAMAGING THE RADOMES AND TO ALLOW FOR ELECTRICAL GROUND TEST OF THE ANTENNA. PLATES RESTING 6.0 INCHES ABOVE THE GROUND IS SUFFICIENT.



AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

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37761 - BOZEMAN, MT - CH. 8

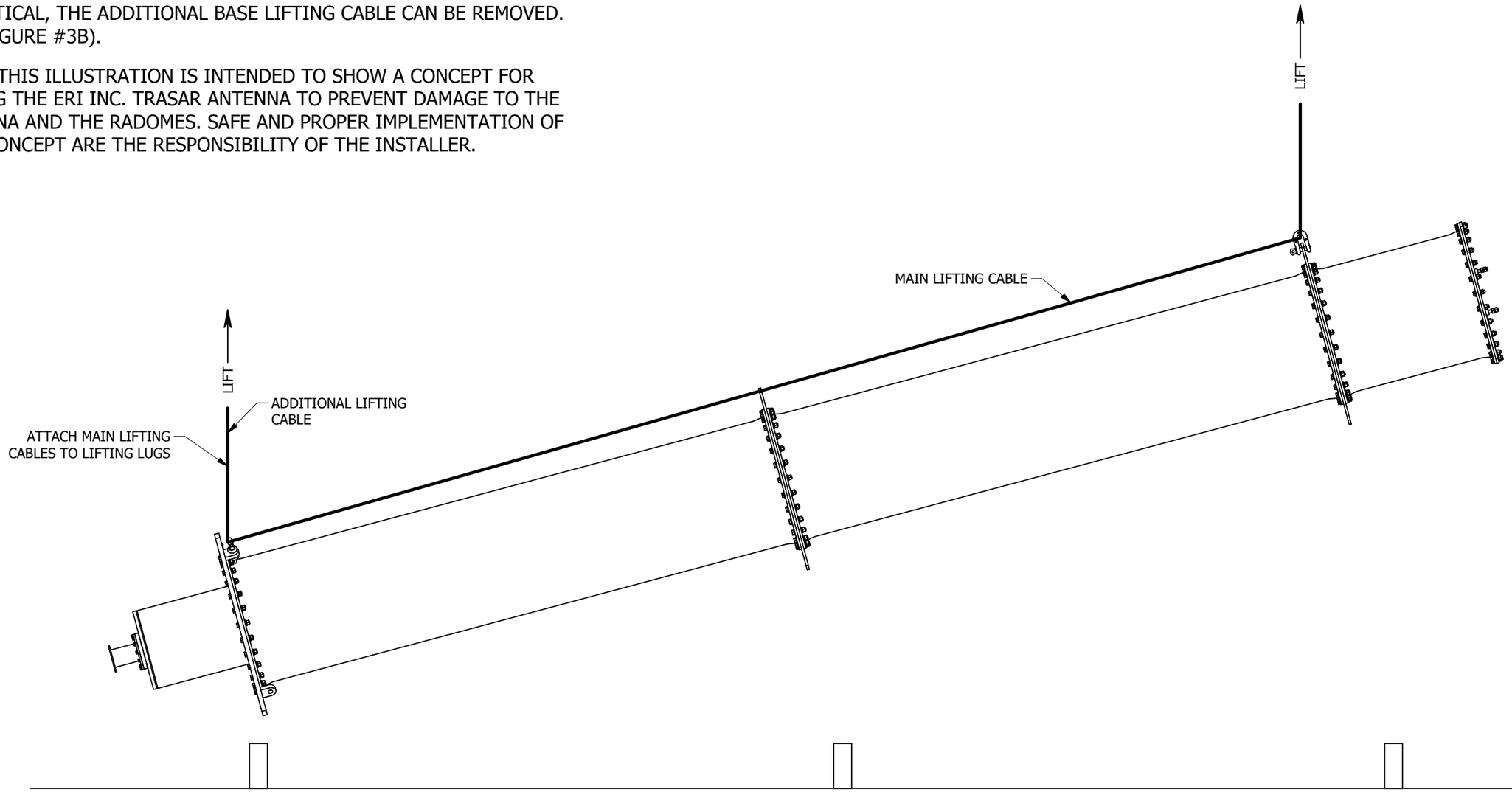
SIZE	CAGE CODE	DWG NO.	REV.
B	OZNS1	LD37761-1	A

SCALE :	WEIGHT:	SHEET:
1 / 25	N/A	2 OF 4

FIGURE #3A

WHEN LIFTING THE ANTENNA FOR INSTALLATION, LIFT AS SHOWN TO PREVENT DAMAGE TO THE BASE OF THE ANTENNA. WHEN THE ANTENNA IS VERTICAL, THE ADDITIONAL BASE LIFTING CABLE CAN BE REMOVED. (SEE FIGURE #3B).

NOTE: THIS ILLUSTRATION IS INTENDED TO SHOW A CONCEPT FOR LIFTING THE ERI INC. TRASAR ANTENNA TO PREVENT DAMAGE TO THE ANTENNA AND THE RADOMES. SAFE AND PROPER IMPLEMENTATION OF THIS CONCEPT ARE THE RESPONSIBILITY OF THE INSTALLER.



AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

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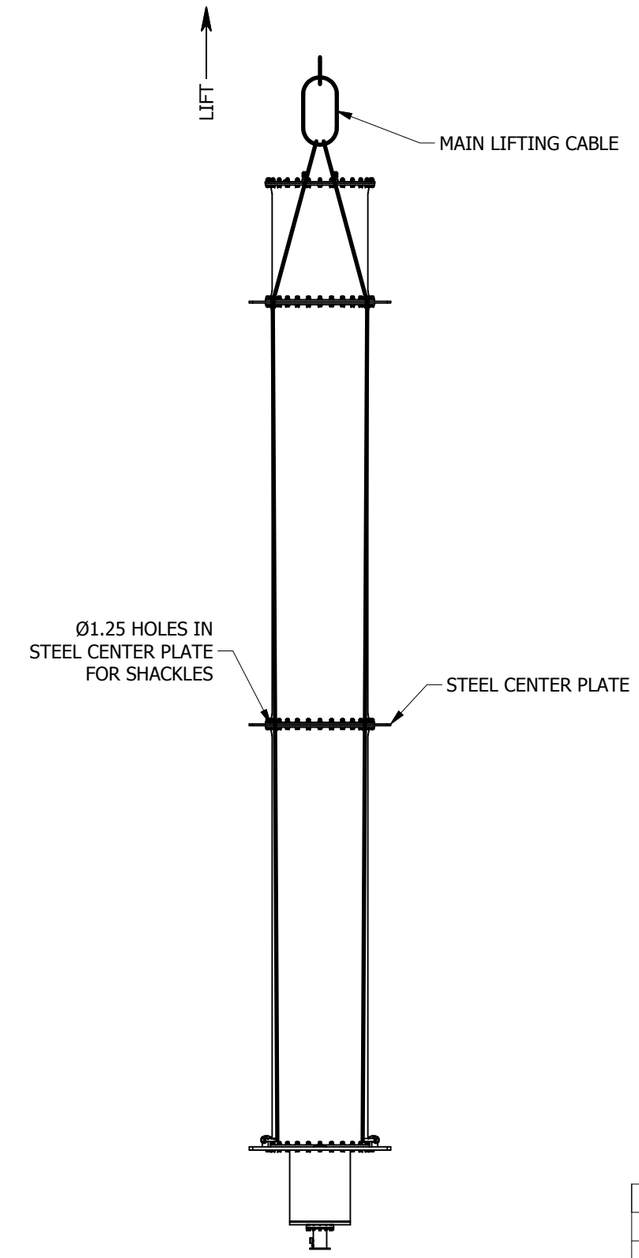
TITLE:
LIFTING DETAILS
37761 - BOZEMAN, MT - CH. 8

SIZE	CAGE CODE	DWG NO.	REV.
B	OZNS1	LD37761-1	A

SCALE :	WEIGHT:	SHEET:
1 / 25	N/A	3 OF 4

FIGURE #3B

NOTE: THIS ILLUSTRATION IS INTENDED TO SHOW A CONCEPT FOR LIFTING THE ERI, INC. TRASAR ANTENNA TO PREVENT DAMAGE TO THE ANTENNA AND THE RADOMES. SAFE AND PROPER IMPLEMENTATION OF THIS CONCEPT ARE THE RESPONSIBILITY OF THE INSTALLER.



AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

MATERIAL

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LIFTING DETAILS
37761 - BOZEMAN, MT - CH. 8

SIZE	CAGE CODE	DWG NO.	REV.
B	OZNS1	LD37761-1	A

SCALE :	WEIGHT:	SHEET:
1 / 25	N/A	4 OF 4

NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES.

2. LOC-TITE ALL THREADS PER BOP 2.02.01.

3. TORQUE ALL 5/8" HARDWARE TO 60-65 FT/LBS.

4. TORQUE ALL 1/2" HARDWARE TO 50-65 FT/LBS.

5. TORQUE ALL 3/8" HARDWARE TO 28 FT/LBS.

6. ALL EXTERIOR HARDWARE TO BE ASSEMBLED WITH THE HEAD OF THE BOLT TOWARDS THE BOTTOM OF THE ANTENNA.

7. USE SMALL ERI SHIPPING LABEL WHERE NOTED.

8. USING BLACK PAINT, STENCIL AS SHOWN, USING MIN. 1/2" HIGH CHARACTERS.

CONNECTION NOTES:

1. FOR PROPER PERFORMANCE AFTER INSTALLATION, PLUMB THE ANTENNA TO WITHIN 0.1° FROM VERTICAL (5/8 INCH IN 30 FEET). A KIT OF SHIMS IS INCLUDED WITH THE ANTENNA. AS REQUIRED FOR PROPER PLUMB, GAPS BETWEEN ANTENNA MOUNTING FLANGE AND TOWER TOP PLATE MUST BE FILLED USING THE SUPPLIED SHIM KIT OR SUITABLE STEEL SHIM STOCK.

2. ANTENNA MOUNTING FLANGE BOLTED CONNECTION SHALL BE BROUGHT TO A SNUG-TIGHT CONDITION WHERE JOINT TIGHTNESS IS ATTAINED WITH A FEW IMPACTS OF AN IMPACT WRENCH OR FULL EFFORT OF AN IRONWORKER USING AN ORDINARY SPUD WRENCH TO BRING THE PLIES INTO "FIRM" CONTACT, AND THEN AN ADDITIONAL 1/3 TURN (120° ± 30°) APPLIED TO THE NUT OR BOLT HEAD FOR FINAL BOLT TIGHTENING. A SYSTEMATIC APPROACH SHALL BE USED WHEN TIGHTENING THE BOLTS STARTING WITH THE MOST RIGID PART OF THE JOINT. THE PART NOT TURNED BY THE WRENCH SHALL BE PREVENTED FROM ROTATING DURING THIS OPERATION.

3. IT IS ERI'S INTENTION THAT AN ANCO LOCKNUT BE PROVIDED FOR ALL HIGH-STRENGTH ASTM A325 BOLTED CONNECTIONS, UNLESS OTHERWISE NOTED. FLAT WASHERS ARE REQUIRED ON MOUNTING FLANGE CONNECTIONS.

4. UNLESS OTHERWISE NOTED, ALL ANTENNA MOUNTING FLANGE HARDWARE GRADES ARE AS FOLLOWS:

TABLE	
COMPONENT	DESCRIPTION
STRUCTURAL BOLT	ASTM A325 GALVANIZED
ANCO LOCKNUT	ASTM A563 GRADE DH GALVANIZED HEAVY HEX NUT WITH STAINLESS PIN
FLAT WASHER	ASTM F436 TYPE I GALVANIZED

ITEM	QTY	PART NUMBER	DESCRIPTION
16	4	HC0096	#96 HOSE CLAMP, SS (FITS 4-1/2" TO 6-1/2")
15	8	NU0616	3/8 - 16 SS HEX NUT, WAX COATED
14	8	WF06SS	3/8 in, SS FLAT WASHER
13	8	WL06SS	3/8 in, SS LOCK WASHER
12	4	UB0616-0325	3/8-16 X 3-1/4" C-C U-BOLT, STAINLESS STEEL
11	6	LR0075-N003	LIGHTNING ROD ARRESTOR TIP
10	2	LR0062-4800GA-N001	5/8"-11 X 48" 30 DEG BENT GALV W/2 NUT
9	2	LRK0007-KIT	LIGHTNING SPUR HARDWARE KIT
8	1	RLA650B-350	6" TO 3" REDUCER
7	1	68157	6" INPUT HARDWARE KIT
6	1	69372	HARDWARE KIT, INPUT ADAPATOR TO SHORT INPUT ADAPTOR
5	1	66593	PRESSURE LABEL
4	1	38296-61	TRASAR LABEL
3	1	VHFINPUT-6.25-2.600	Ø6.25 VHF STRAIGHT INPUT ADAPTOR
2	2	BT37761-1	LEG TO LINE BRACKET
1	1	TA37761-1	TOP LEVEL ASSEMBLY

BILL OF MATERIAL

PROJECT NO.	37761/1	
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DRAWN BY	LMJ	11/27/2019
DRAFTING	GAG	12/3/2019
DESIGN MGR.	K.SCHARP	12/3/2019
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EXT. APPROVAL		

SUPERSEDES PART NO.

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ESTABLISHED 1943
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CHANDLER, IN
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PHONE: (812) 925-6000
FAX: (812) 925-4030

TITLE:
MECH. PARAMETERS / INSTALLATION ASS'Y.
37761 - BOZEMAN, MT - CH. 8

SIZE	CAGE CODE	DWG NO.	REV.
B	OZNS1	PM37761-1	

SCALE :	WEIGHT:	SHEET:
1 / 35	N/A	1 OF 3

AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

MATERIAL

FINISH

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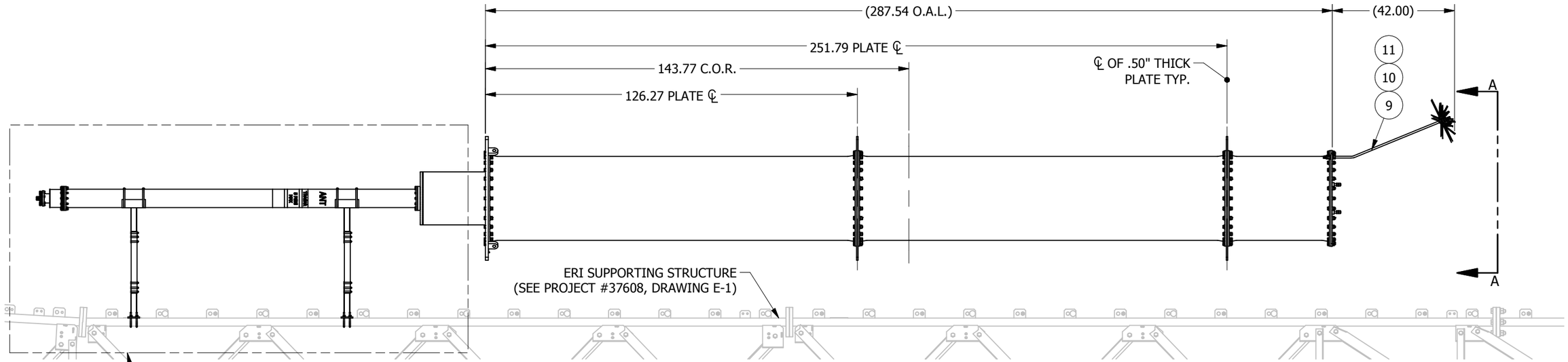
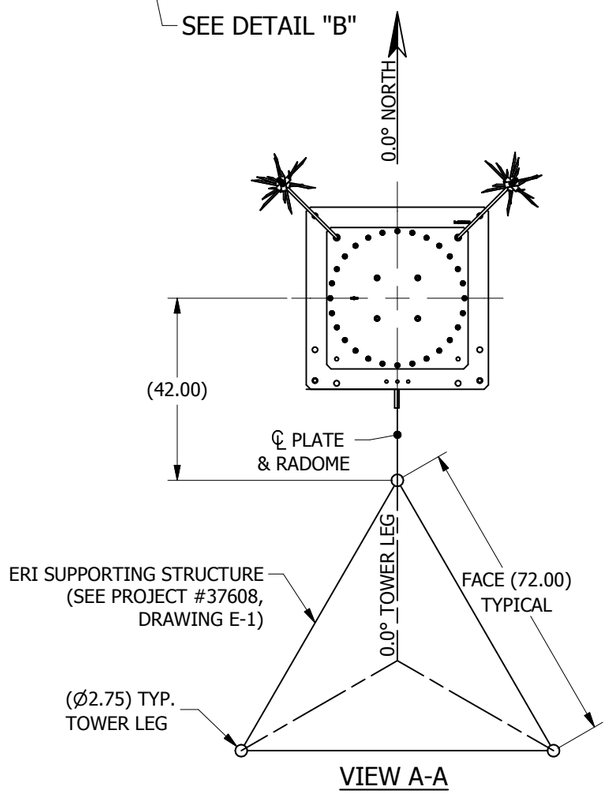
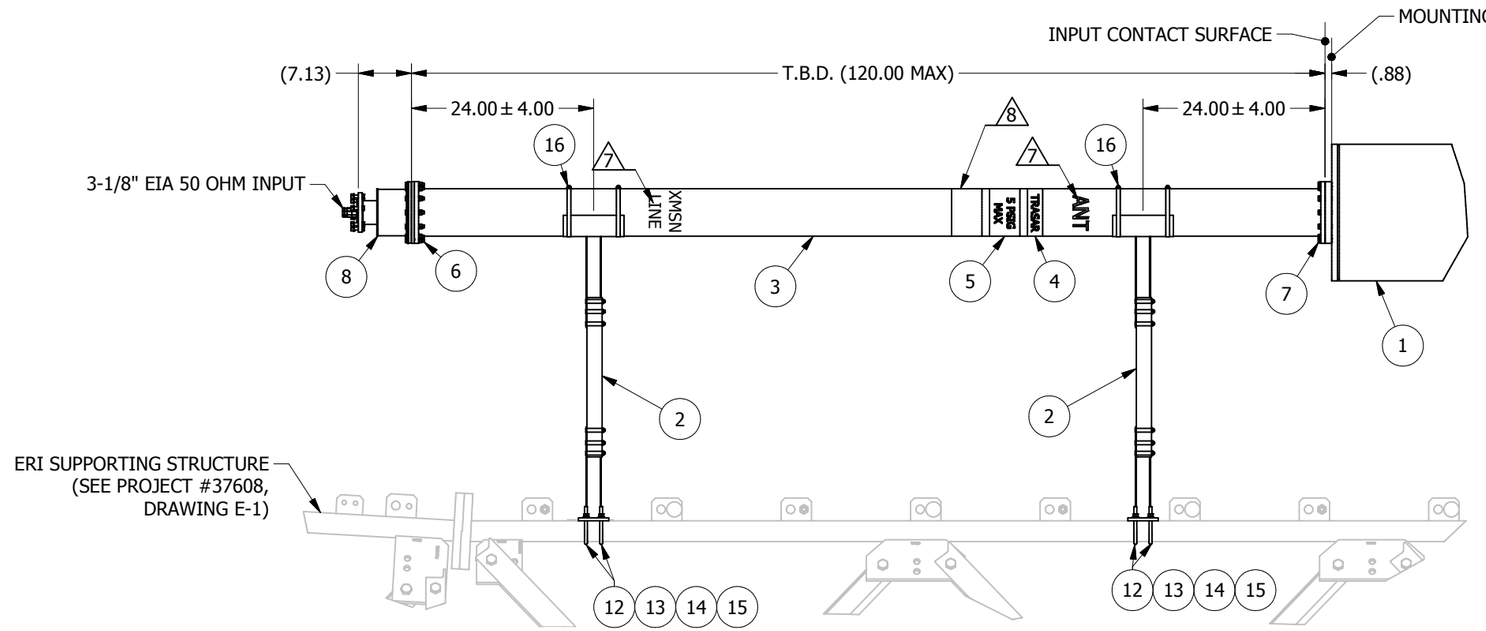




VIEW A-A



DETAIL B

PROJECT NO.	37761/1	
ERI APPROVAL	NAME	DATE
DRAWN BY	LMJ	11/27/2019
DRAFTING	GAG	12/3/2019
DESIGN MGR.	K.SCHARP	12/3/2019
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B	OZNS1	PM37761-1	

SCALE :	WEIGHT:	SHEET:
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AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

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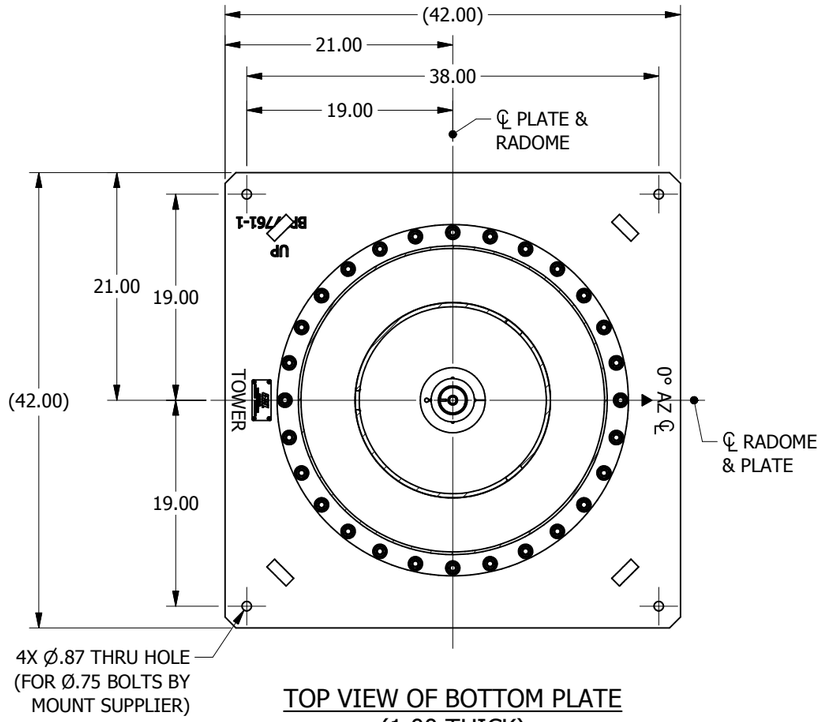
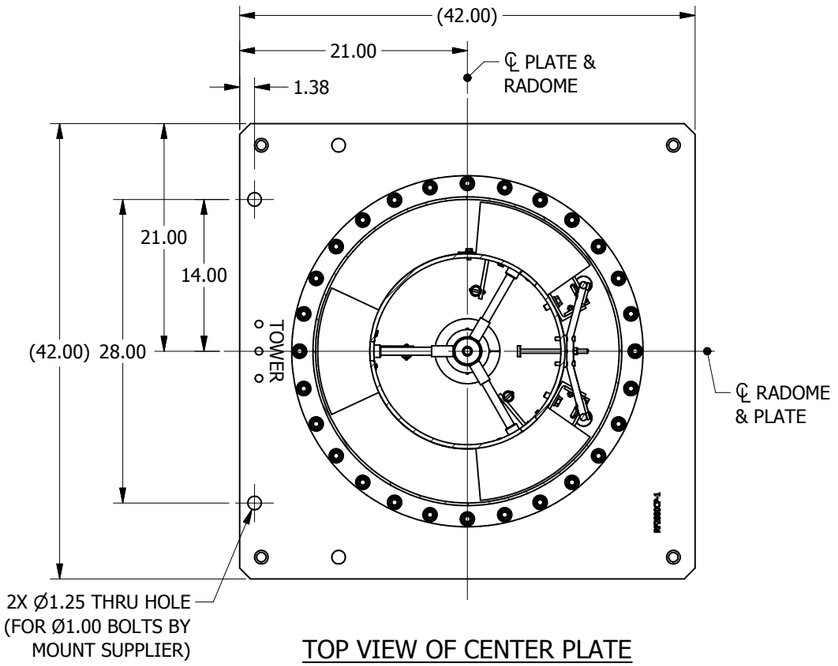
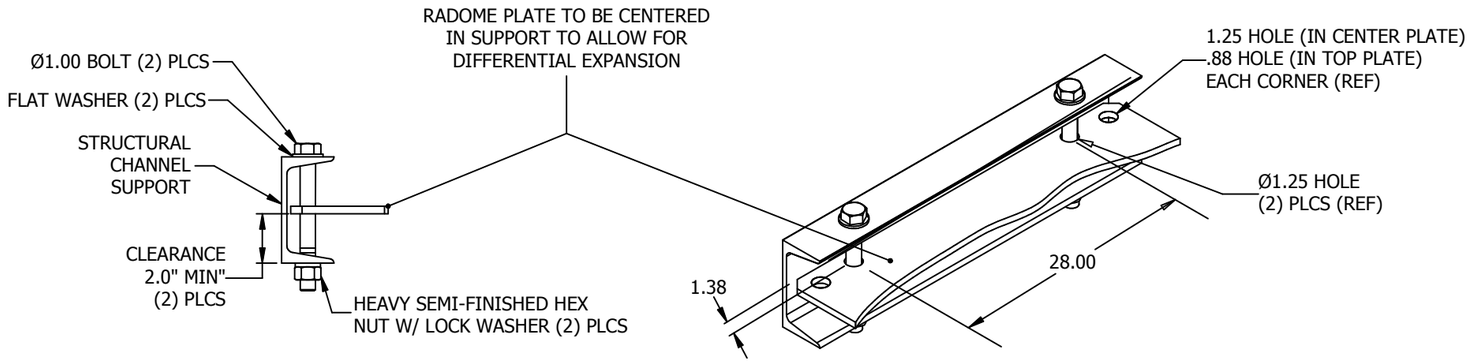


TOP VIEW OF BOTTOM PLATE
(1.00 THICK)



TOP VIEW OF CENTER PLATE
(.50 THICK)
TYP. 2X



NOTE: POSSIBLE MOUNTING FOR TOP
PLATE AND CENTER PLATES
TO HORIZONTAL SUPPORTS

AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

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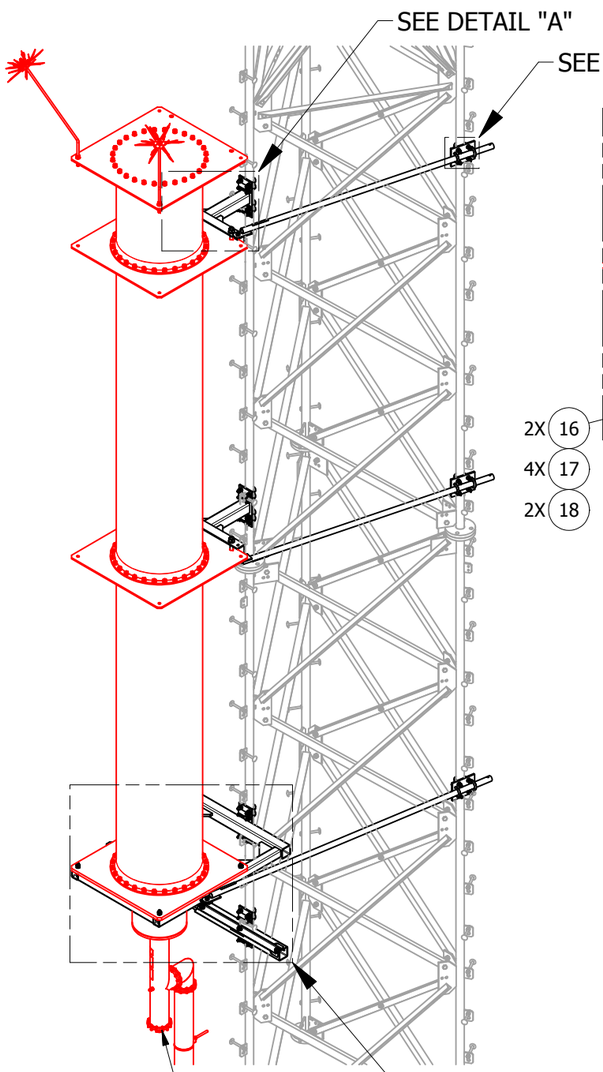
SIZE	CAGE CODE	DWG NO.	REV.
B	OZNS1	PM37761-1	

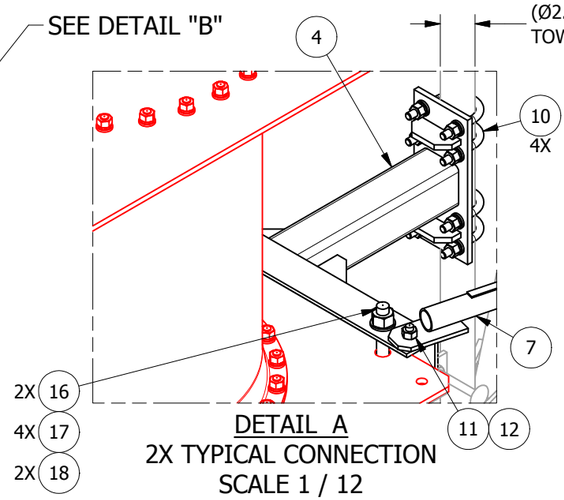
SCALE :	WEIGHT:	SHEET:
1 / 35	N/A	3 OF 3

SPECIAL NOTES:

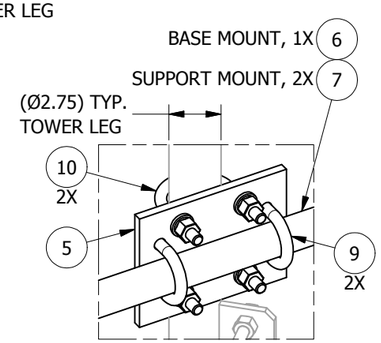
PLACEMENT OF ANTENNA & MOUNTS WERE DETERMINED USING INFORMATION PROVIDED BY ELECTRONICS RESEARCH, INC. GENERAL TOWER INFORMATION IS IN ERI PROJECT No. 37608, DRAWING No. "E-1", DATED AUGUST 14, 2019. TYPICAL TOWER DETAILS ARE IN DRAWING No. "37608-C1E" & 37608-C1F", DATED SEPTEMBER 3, 2019.



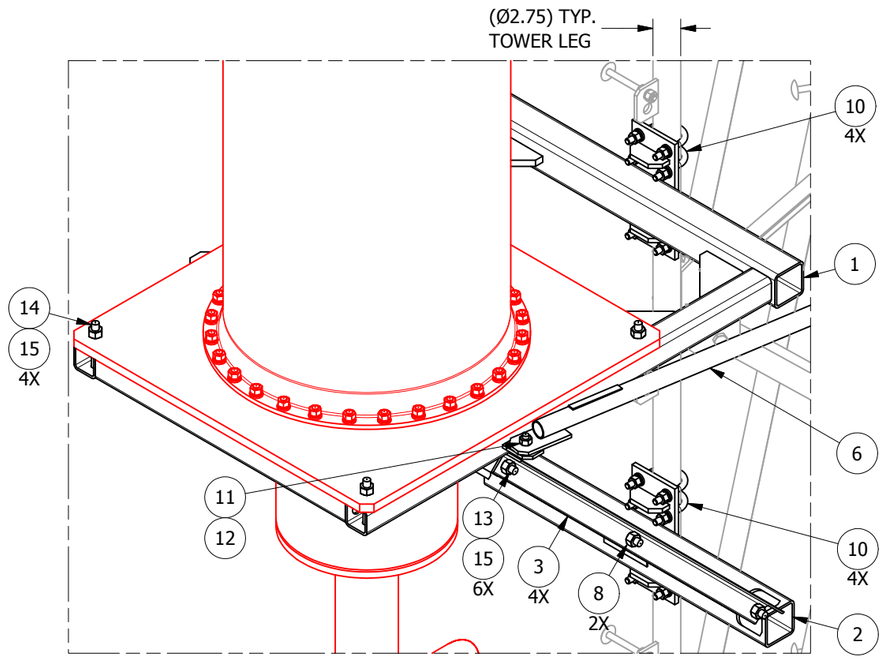
ISOMETRIC VIEW
SCALE 1 / 50



DETAIL A
2X TYPICAL CONNECTION
SCALE 1 / 12



DETAIL B
3X TYPICAL CONNECTION
SCALE 1 / 8



DETAIL C
SCALE 1 / 15

STANDARD STRUCTURAL BOLTED CONNECTION NOTES:

1. IT IS ERI'S INTENTION THAT A NUT LOCKING DEVICE BE PROVIDED ON ALL BOLTED CONNECTIONS, UNLESS OTHERWISE SPECIFIED.

2. FLAT WASHERS ARE NOT REQUIRED ON CONNECTIONS WITH STANDARD HOLES, BUT MAY BE PROVIDED AND INSTALLED TO ACCOUNT FOR BOLT ASSEMBLY TOLERANCES TO PREVENT NUT JAMMING IN CASE THE BOLT SHANK PROTRUDES OUTSIDE OF THE CONNECTED PLIES. ASTM F436 FLAT WASHERS ARE REQUIRED FOR ALL CONNECTIONS WITH OVERSIZED OR SHORT- SLOTTED HOLES. STRUCTURAL STEEL GRADE PLATE WASHERS OR A CONTINUOUS BAR NOT LESS THAN 5/16" THICK SHALL BE USED FOR ALL CONNECTIONS WITH LONG-SLOTTED HOLES.

3. UNLESS OTHERWISE NOTED, ALL BOLTED CONNECTIONS SHALL INITIALLY BE BROUGHT TO A SNUG-TIGHT CONDITION WHERE JOINT TIGHTNESS IS ATTAINED WITH A FEW IMPACTS OF AN IMPACT WRENCH OR THE FULL EFFORT OF AN IRONWORKER USING AN ORDINARY SPUD WRENCH TO BRING THE PLIES INTO FIRM CONTACT. A SYSTEMATIC APPROACH SHALL BE USED TO BRING THE JOINT INTO A SNUG-TIGHT CONDITION STARTING WITH THE MOST RIGID PART OF THE JOINT AND PROCEEDING TOWARD THE FREE EDGES.

4. FOR FINAL TIGHTENING, ERI RECOMMENDS AN ADDITIONAL 1/3 TURN BE APPLIED TO ALL BOLTS UP TO Ø3/4" OR TORQUED AN ADDITIONAL 150 FT-LBS FOR BOLTS OVER Ø3/4", UNLESS OTHERWISE NOTED. FINAL TIGHTENING OF ALL BOLTS SHOULD BE COMPLETED AFTER FINAL CONSTRUCTION OF THE STRUCTURE/ ASSEMBLY. PLEASE NOTE, SPECIAL ATTENTION SHALL BE GIVEN TO TIGHTENING OF 1/2"-DIAMETER A325 BOLTS, U-BOLTS, AND THREADED RODS AS TO PREVENT STRIPPING THE THREADS FROM OVER-TIGHTENING.

ASTM A325 BOLTS	
BOLT DIAMETER	SOCKET SIZE
1/2"	7/8"
5/8"	1-1/16"
3/4"	1-1/4"
7/8"	1-7/16"
1"	1-5/8"
1-1/8"	1-13/16"
1-1/4"	2"
1-3/8"	2-3/16"
1-1/2"	2-3/8"

ITEM	QTY	PART NUMBER	DESCRIPTION
18	4	NLA1608GA	1-8 GALV. ANCO LOCK NUT
17	8	WF16GA	1" FLAT WASHER F436 HDG STRUCTURAL
16	4	SC1608H0800GA	1-8 UNC x 8.00 in A325 Galv. Hex Bolt
15	10	NLA1210GA	3/4-10 GALV. ANCO LOCK NUT
14	4	SC1210H0550GA	3/4-10 UNC x 5.50 in A325 Galv. Hex Bolt
13	6	SC1210H0225GA	3/4-10 UNC x 2.25 in A325 Galv. Hex Bolt
12	3	NLA1011GA	5/8-11 GALV. ANCO LOCK NUT
11	3	SC1011H0175GA	5/8-11 UNC x 1.75 in A325 Galv. Hex Bolt
10	22	UB1011-0387GA2	5/8-11 X 3-7/8" C-C GALV. U-BOLT W/NUT LW&FW
9	6	UB1011-0287GA2	5/8-11 x 2-7/8" C-C GALV. U-BOLT W/NUT LW&FW
8	2	SBS0037	STITCH BOLT SPACER
7	2	FRM0005-96	8'-0" TIEBACK WELDMENT (1.900" O.D.)
6	1	FRM0005-114	9'-6" TIEBACK WELDMENT (1.900" O.D.)
5	3	TB0050-0288-0388	Ø1.90 TIEBACK CONNECTION PLATE, 1/2"
4	2	37761-SW1	SUPPORT MOUNT WELDMENT
3	4	KM0001-51.94	KICKER ANGLE, 2-1/2" X 2-1/2" X 1/4"
2	1	37761-KW1	KICKER MOUNT WELDMENT
1	1	37761-BW1	BASE MOUNT WELDMENT

BILL OF MATERIAL

AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

MATERIAL

FINISH

TOLERANCES
OVERALL-NOT CUMULATIVE
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES AND APPLICABLE AT 20°C (68°F)
INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994

1 PLACE DECIMAL ± .1
2 PLACE DECIMAL ± .03
3 PLACE DECIMAL ± .010
ANGULAR ± .5°
FRACTIONAL ± 1/16"

PROJECT NO.	37761/2	
ERI APPROVAL	NAME	DATE
DRAWN BY	MAP	11/4/2019
DRAFTING		
DESIGN MGR.	K.SCHARP	11/11/2019
ENG.	JWR	11/12/2019
MANUF.		
EXT. APPROVAL		

SUPERSEDES PART NO.

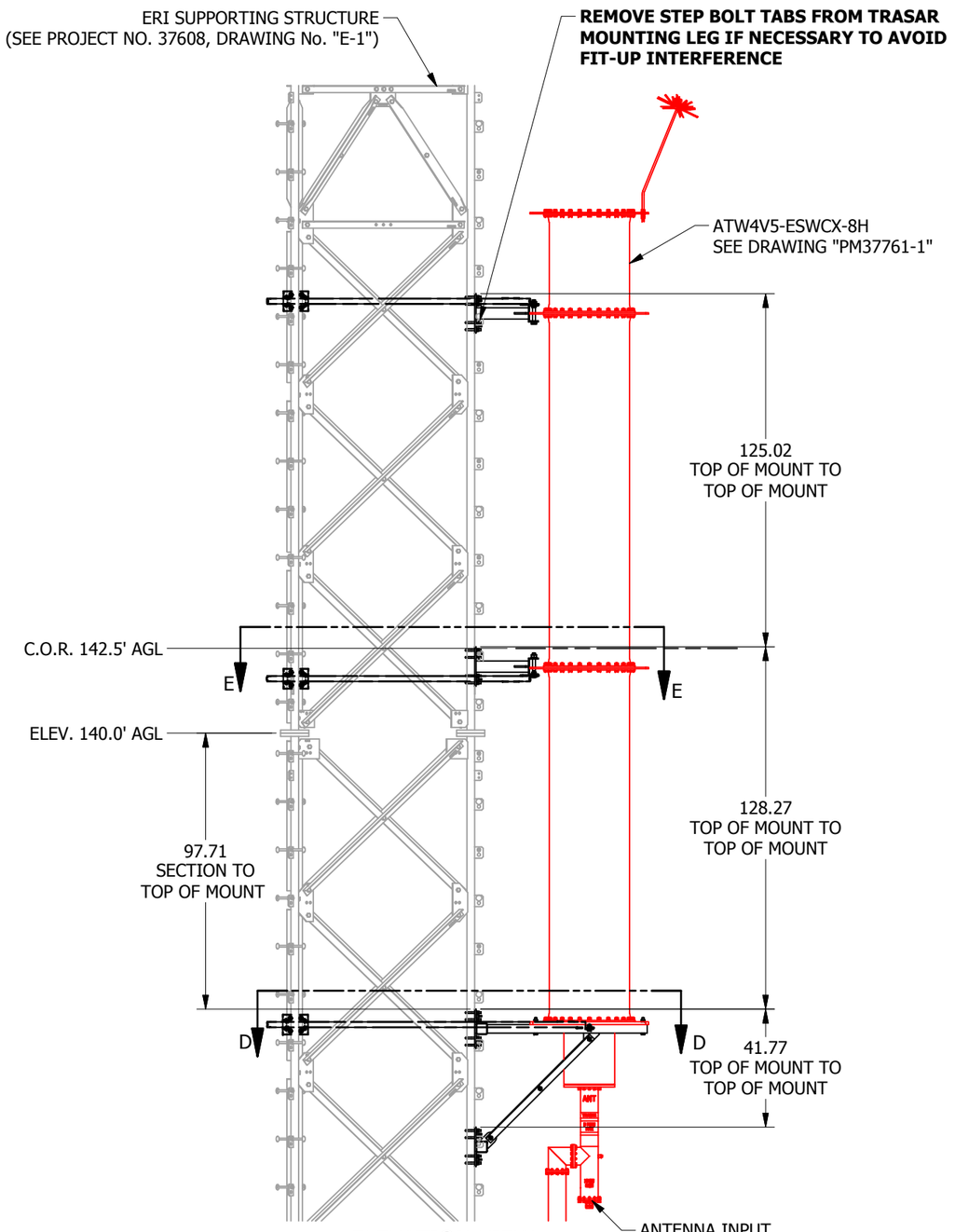
FILE NAME: 37761-A1.idw

ELECTRONICS RESEARCH INC.
ESTABLISHED 1943
7777 GARDNER Rd.
CHANDLER, IN
47610-9219
PHONE: (812) 925-6000
FAX: (812) 925-4030

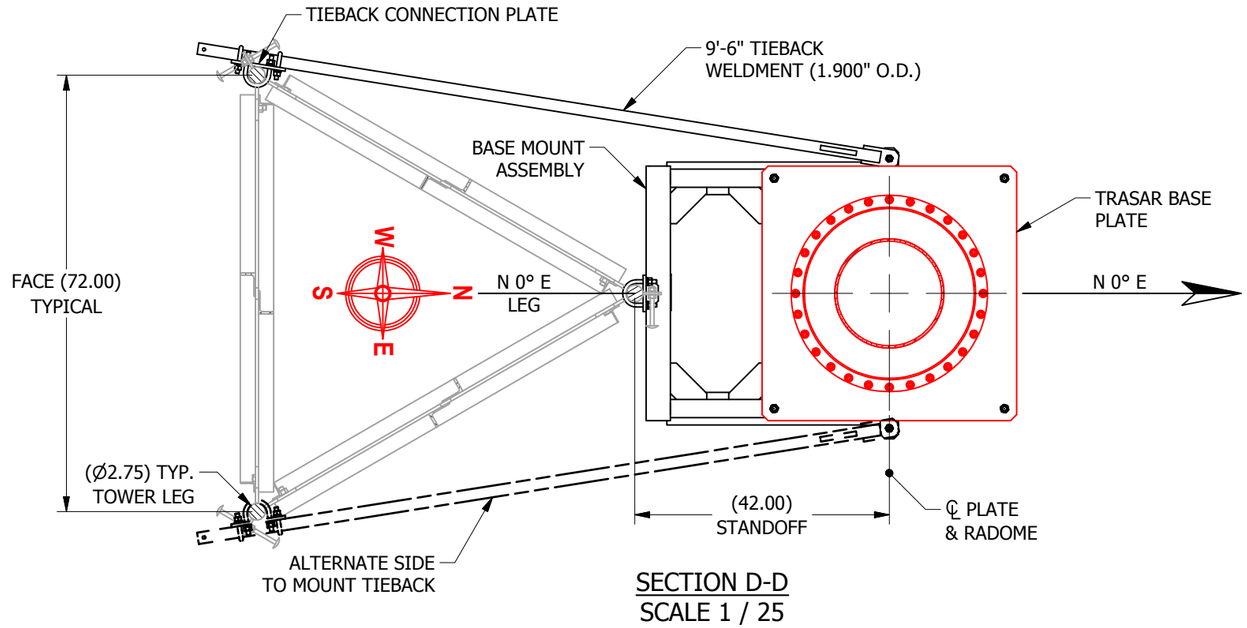
TITLE:
TRASAR LEG MOUNT INSTALLATION DETAILS
BOZEMAN, MT
KUSM - TV CHANNEL 8

SIZE	CAGE CODE	DWG NO.	REV.
B	OZNS1	37761-A1	

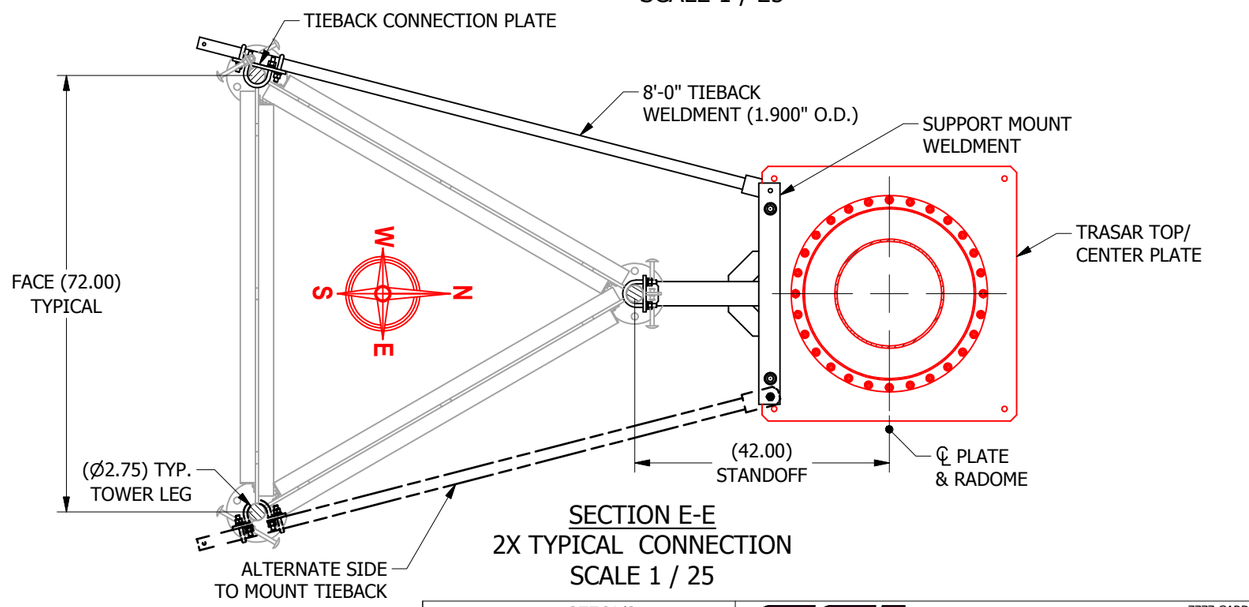
SCALE :	WEIGHT:	SHEET:
AS NOTED	670.42 lbmass	1 OF 2



ELEVATION VIEW
SCALE 1 / 50



SECTION D-D
SCALE 1 / 25



SECTION E-E
2X TYPICAL CONNECTION
SCALE 1 / 25

AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

MATERIAL

FINISH

TOLERANCES
OVERALL-NOT CUMULATIVE
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES AND APPLICABLE AT 20°C (68°F)
INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994

1 PLACE DECIMAL ± .1
2 PLACE DECIMAL ± .03
3 PLACE DECIMAL ± .010
ANGULAR ± .5°
FRACTIONAL ± 1/16"

PROJECT NO.	37761/2	
ERI APPROVAL	NAME	DATE
DRAWN BY	MAP	11/4/2019
DRAFTING		
DESIGN MGR.	K.SCHARP	11/11/2019
ENG.	JWR	11/12/2019
MANUF.		
EXT. APPROVAL		
SUPERSEDES PART NO.		
FILE NAME: 37761-A1.idw		

ELECTRONICS RESEARCH INC.
ESTABLISHED 1943
7777 GARDNER Rd.
CHANDLER, IN
47610-9219
PHONE: (812) 925-6000
FAX: (812) 925-4030

TITLE:
TRASAR LEG MOUNT INSTALLATION DETAILS
BOZEMAN, MT
KUSM - TV CHANNEL 8

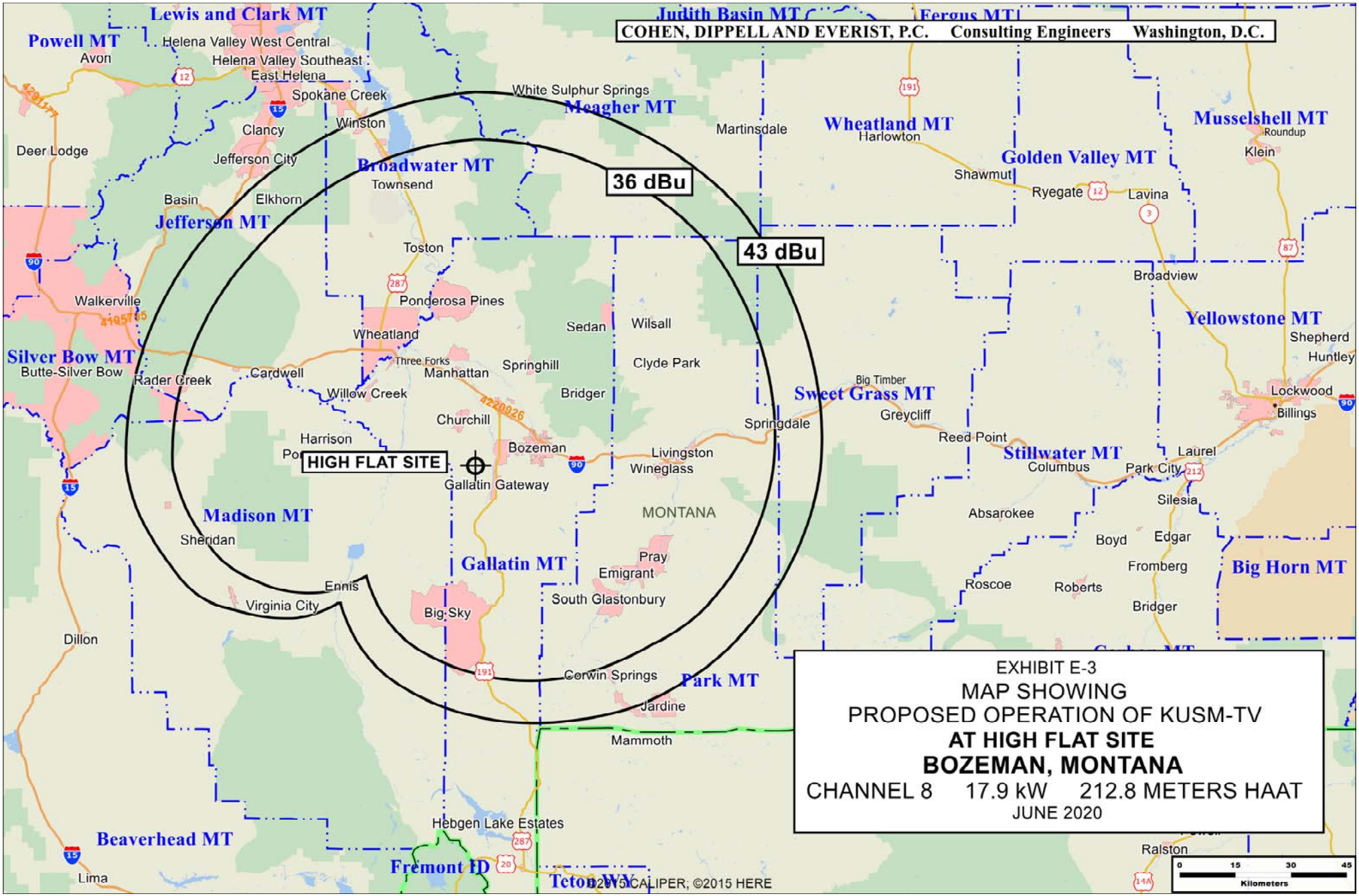
SIZE	CAGE CODE	DWG NO.	REV.
B	OZNS1	37761-A1	
SCALE : AS NOTED	WEIGHT: 670.42 lbmass	SHEET: 2 OF 2	

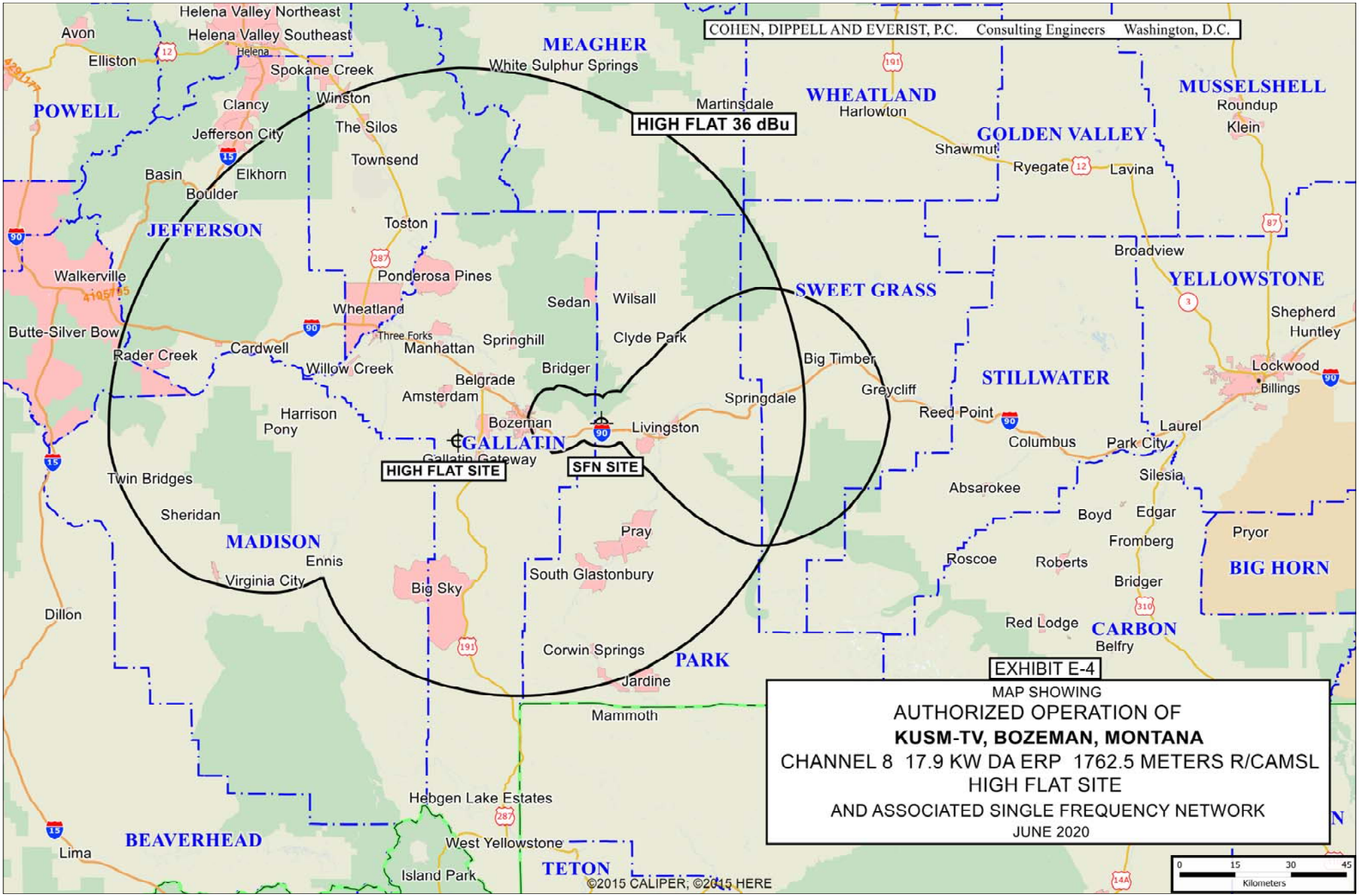
TABLE I
COMPUTED COVERAGE DATA
FOR THE PROPOSED DTV OPERATION OF
KUSM-TV, BOZEMAN, MONTANA
CHANNEL 8 17.9 KW (MAX) ERP 17.9 KW (H)/5.37 KW (V) ERP 212.8 METERS HAAT
JUNE 2020

Radial Bearing (N ° E, T)	Average* Elevation 3.2 to 16.1 km meters	Effective Height meters	Depression Angle degrees	ERP At Radio Horizon kW	Distance to Contour F(50/90) 43 dBu City Grade km	36 dBu Noise-Limited km
0	1415.1	347.4	0.516	17.900	87.9	100.5
10	1416.9	345.6	0.515	17.758	87.7	100.3
20	1418.7	343.8	0.514	17.402	87.4	100.0
30	1420.5	342.0	0.512	16.877	87.1	99.6
40	1422.3	340.2	0.511	16.327	86.7	99.2
50	1432.9	329.6	0.503	15.816	85.7	98.0
60	1452.2	310.3	0.488	15.350	84.1	96.3
70	1471.6	290.9	0.472	14.887	82.7	95.0
80	1490.9	271.6	0.457	14.371	81.5	93.9
90	1510.2	252.3	0.440	13.674	80.1	92.7
100	1534.3	228.2	0.418	12.782	78.2	90.5
110	1558.4	204.1	0.396	11.773	75.8	88.0
120	1582.4	180.1	0.372	10.641	73.2	85.4
130	1606.5	156.0	0.346	9.565	69.8	82.6
140	1625.4	137.1	0.324	8.622	66.3	79.4
150	1639.2	123.3	0.308	7.869	63.7	75.9
160	1652.9	109.6	0.290	7.355	61.2	72.6
170	1666.7	95.8	0.271	7.060	58.6	69.7
180	1680.5	82.0	0.251	6.969	55.9	66.8
190	1691.9	70.6	0.233	7.060	53.5	64.3
200	1703.4	59.1	0.213	7.355	51.1	61.9
210	1714.8	47.7	0.191	7.869	47.9	58.5
220	1726.3	36.2	0.167	8.622	43.9	54.1
230	1704.3	58.2	0.211	9.565	52.6	63.4
240	1648.8	113.7	0.295	10.641	64.4	76.1
250	1593.4	169.1	0.360	11.773	73.0	85.2
260	1538.0	224.5	0.415	12.782	77.9	90.2
270	1482.5	280.0	0.463	13.674	81.5	93.9
280	1482.6	279.9	0.463	14.371	81.9	94.3

TABLE I
COMPUTED COVERAGE DATA
FOR THE PROPOSED DTV OPERATION OF
KUSM-TV, BOZEMAN, MONTANA
CHANNEL 8 17.9 KW (MAX) ERP 17.9 KW (H)/5.37 KW (V) ERP 212.8 METERS HAAT
JUNE 2020

Radial Bearing (N ° E, T)	Average* Elevation 3.2 to 16.1 km meters	Effective Height meters	Depression Angle degrees	ERP At Radio Horizon kW	Distance to Contour F(50/90) 43 dBu City Grade km	36 dBu Noise-Limited km
290	1482.6	279.9	0.463	14.887	82.1	94.5
300	1482.7	279.8	0.463	15.350	82.4	94.8
310	1482.8	279.7	0.463	15.816	82.6	95.0
320	1475.3	287.2	0.469	16.327	83.2	95.5
330	1460.2	302.3	0.482	16.877	84.3	96.5
340	1445.2	317.3	0.493	17.402	85.5	97.8
350	1430.1	332.4	0.505	17.758	86.7	99.2


COHEN, DIPPELL AND EVERIST, P.C. Consulting Engineers Washington, D.C.
36 dBu
43 dBu
HIGH FLAT SITE
Lewis and Clark MT
Powell MT
Judith Basin MT
Fergus MT
Meagher MT
Wheatland MT
Musselshell MT
Golden Valley MT
Broadwater MT
Jefferson MT
Yellowstone MT
Silver Bow MT
Sweet Grass MT
Stillwater MT
Madison MT
Gallatin MT
Big Horn MT
Park MT
Beaverhead MT
Fremont ID
Teton WY
MONTANA
Helena Valley West Central
Helena Valley Southeast
East Helena
Spokane Creek
White Sulphur Springs
Martinsdale
Harlowton
Roundup
Klein
Shawmut
Ryegate
Lavina
Broadview
Deer Lodge
Avon
Clancy
Jefferson City
Winston
Townsend
Basin
Elkhorn
Toston
Ponderosa Pines
Wheatland
Sedan
Wilsall
Clyde Park
Three Forks
Manhattan
Springhill
Bridger
Willow Creek
Cardwell
Rader Creek
Butte-Silver Bow
Walkerville
Shepherd
Huntley
Lockwood
Billings
Big Timber
Greycliff
Springdale
Reed Point
Columbus
Park City
Laurel
Silesia
Absarokee
Boyd
Edgar
Fromberg
Roscoe
Roberts
Bridger
Churchill
Harrison
Bozeman
Livingston
Wineglass
Gallatin Gateway
Sheridan
Ennis
Virginia City
Big Sky
Pray
Emigrant
South Glastonbury
Dillon
Corwin Springs
Jardine
Mammoth
Hebgen Lake Estates
Lima
Ralston
EXHIBIT E-3
MAP SHOWING
PROPOSED OPERATION OF KUSM-TV
AT HIGH FLAT SITE
BOZEMAN, MONTANA
CHANNEL 8 17.9 kW 212.8 METERS HAAT
JUNE 2020
0 15 30 45
Kilometers
©2015 CALIPER, ©2015 HERE


COHEN, DIPPELL AND EVERIST, P.C. Consulting Engineers Washington, D.C.
HIGH FLAT 36 dBu
HIGH FLAT SITE
SFN SITE
EXHIBIT E-4
MAP SHOWING
AUTHORIZED OPERATION OF
KUSM-TV, BOZEMAN, MONTANA
CHANNEL 8 17.9 KW DA ERP 1762.5 METERS R/CAMSL
HIGH FLAT SITE
AND ASSOCIATED SINGLE FREQUENCY NETWORK
JUNE 2020
©2015 CALIPER, ©2015 HERE
Kilometers
Helena Valley Northeast
Helena Valley Southeast
Avon
Elliston
Helena
Spokane Creek
Winston
Clancy
Jefferson City
The Silos
Townsend
Basin
Elkhorn
Boulder
Toston
Ponderosa Pines
Walkerville
Wheatland
Butte-Silver Bow
Three Forks
Manhattan
Springhill
Rader Creek
Cardwell
Willow Creek
Belgrade
Amsterdam
Harrison
Pony
Bozeman
Gallatin Gateway
Twin Bridges
Sheridan
Ennis
Virginia City
Dillon
Big Sky
Pray
South Glastonbury
Corwin Springs
Jardine
Mammoth
Hebgen Lake Estates
West Yellowstone
Island Park
Lima
Martinsdale
White Sulphur Springs
Sedan
Wilsall
Clyde Park
Bridger
Springdale
Livingston
Big Timber
Greycliff
Reed Point
Columbus
Park City
Laurel
Billings
Lockwood
Shepherd
Huntley
Broadview
Harlowton
Shawmut
Ryegate
Lavina
Roundup
Klein
Absarokee
Silesia
Boyd
Edgar
Fromberg
Pryor
Roscoe
Roberts
Bridger
Red Lodge
Belfry
MEAGHER
WHEATLAND
MUSSELSHELL
POWELL
JEFFERSON
GOLDEN VALLEY
SWEET GRASS
YELLOWSTONE
STILLWATER
MADISON
GALLATIN
PARK
BIG HORN
CARBON
BEAVERHEAD
TETON
0 15 30 45