

ENGINEERING STATEMENT
TECHNICAL INFORMATION IN SUPPORT OF A
CONSTRUCTION PERMIT MODIFICATION FOR
K20HB, BILLINGS, MONTANA
CHANNEL 20 (+) 58 KW ERP DA MAX 1163 METERS RCAMSL

AUGUST 2004

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

COHEN, DIPPELL AND EVERIST, P. C.

City of Washington)
) ss
District of Columbia)

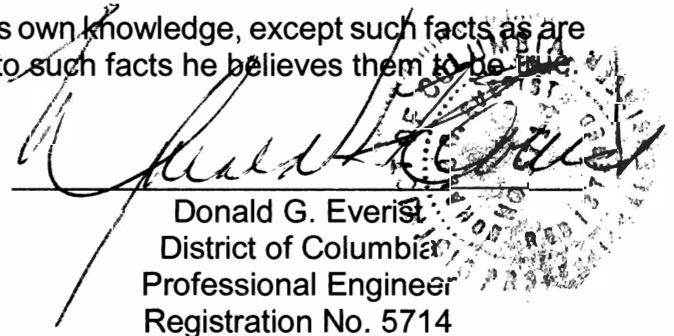
Donald G. Everist, being duly sworn upon his oath, deposes and states that:

He is a graduate electrical engineer, a Registered Professional Engineer in the District of Columbia, and is President, Secretary and Treasurer of Cohen, Dippell and Everist, P.C., Consulting Engineers, Radio - Television, with offices at 1300 L Street, N.W., Suite 1100, Washington, D.C. 20005;

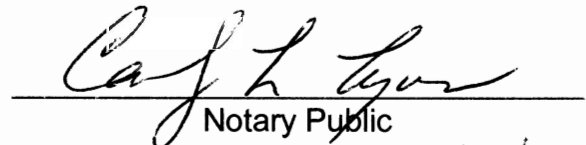
That his qualifications are a matter of record in the Federal Communications Commission;

That the attached engineering report was prepared by him or under his supervision and direction and

That the facts stated herein are true of his own knowledge, except such facts as are stated to be on information and belief, and as to such facts he believes them to be true.


Donald G. Everist
District of Columbia
Professional Engineer
Registration No. 5714

Subscribed and sworn to before me this 21st day of September, 2004.


Notary Public

My Commission Expires: 2/28/2008



COHEN, DIPPELL AND EVERIST, P. C.

City of Washington)
) ss
District of Columbia)

Martin R. Doczkat being duly sworn upon his oath, deposes and states that:

He is a graduate electrical engineer of the Pennsylvania State University, and is a staff engineer at Cohen, Dippell and Everist, P.C., Consulting Engineers, Radio - Television, with offices at 1300 L Street, N.W., Suite 1100, Washington, D.C. 20005;

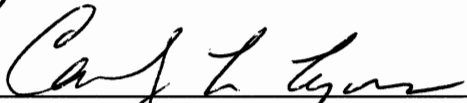
That the attached engineering report was prepared by him or under his supervision and direction and

That the facts stated herein are true of his own knowledge, except such facts as are stated to be on information and belief, and as to such facts he believes them to be true.



Martin R. Doczkat

Subscribed and sworn to before me this 21st day of September, 2004.



Notary Public

My Commission Expires: 2/28/2008



INTRODUCTION

This engineering statement has been prepared on behalf of Montana State University, licensee of KUSM(TV), in support of its minor modification of its authorized facility for K20HB, Billings, Montana contained in the construction permit (FCC File No. BNPTT-20000803ABO). This application proposes to change the location of operation of K20HB from that specified in the authorized construction permit. A slight decrease in the center of radiation above mean sea level, effective radiated power ("ERP"), and height above average terrain ("HAAT") will result due to the change in site location. No other changes are proposed.

TRANSMITTER SITE

The antenna will be mounted to an existing tower (Exhibit E-1) where the authorized KTVQ(TV) facility is currently located. The tower is located near Coburn Road, Mile Marker 2. The geographic coordinates of the site follow below. The tower registration number is 1001064.

North Latitude: 45° 46' 00'

West Longitude: 108° 27' 27'

NAD-27

ELEVATION DATA

Elevation of site above mean sea level	1118.0 Meters 3668.0 Feet
Overall height above ground of the existing antenna structure (including appurtenances)	116.7 Meters 382.9 Feet
Overall height above mean sea level of the existing antenna structure (including appurtenances)	1234.7 Meters 4050.9 Feet
Antenna vertical height	11 Meters 35.9 Feet

Center of radiation of antenna above ground level	45 Meters 147.6 Feet
Center of radiation of antenna above mean sea level	1163.0 Meters 3815.6 Feet
Center of radiation above average terrain	113 Meters 370.7 Feet

All of the elevation data included above can be found on the vertical tower sketch of the supporting included as Exhibit E-1 of this report.

EQUIPMENT DATA

Transmission Line:	Dielectric, 50 ohm, 1-5/8", FlexLine, 76 Meters (250 Feet) with 72.5% efficiency
Antenna:	Dielectric, TLP-16B directional with 1° electrical beam tilt

Power Data

Transmitter Power Output	5 kW	6.99 dBk
Transmission Line Loss	72.5%	1.40 dB
Input Power to the Antenna	3.63 kW	5.59 dBk
Antenna Power Gain, Main Lobe	16.0	12.04 dB
Effective Radiated Power, Maximum	58.0 kW	17.63 dBk

The vertical plane pattern and other exhibits required by Section 73.685(f) of the Rules are included in Exhibits E-2a through E-2f.

Table I includes the distance to the F(50,50) 74 dBu coverage contour, the average elevation 3.2 to 16.1 km, and the antenna height above average terrain for every ten degrees.

INTERFERENCE ANALYSIS

An LPONE study was performed to predict whether significant interference will be caused by the proposed station. LPONE selects and studies those stations within the required minimum distance separation of the proposed station. All of the stations listed as potentially affected, as determined by LPONE, did not experience any interference from the proposed operation of K20HB, except for co-owned K20DY which is located 219.3 km from the proposed site.

To verify the LPONE results, a Longley-Rice study was performed using a version of the Longley-Rice program as described in OET Bulletin No. 69 (July 2, 1997) and the Public Notice, "Additional Application Processing Guidelines for Digital Television (DTV)" (August 1998). The FCC's FORTRAN-77 code was modified only to the extent necessary (primarily input/output handling) for the program to run on a Windows98/Intel platform. Comparison of service/interference areas and populations indicates that this model closely matches the FCC's evaluation program. Best efforts have been made to use data and calculations identical to the FCC's program. Any slight differences are attributable to compiler, operating system and/or processor characteristics. The effect of any variance in calculated population values versus the FCC's program is minimized when differencing a given model's results, such as calculating new interference as total interference less baseline interference. Any variance effect is further reduced when using ratios of calculated population values such as measuring the incremental population affected as a percent of the total population served. The model employs the Longley-Rice propagation methodology and evaluates in grid cells of approximately 4 km² using 3-second terrain data sampled approximately every 1.0 km at one degree azimuth intervals with 1990 census centroids.

The stations to be considered for potential interference, according to the processing guidelines cited above are listed in Table II. All of the stations listed as potentially affected,

according to the Longley-Rice study, are predicted to experience no new interference from the proposed station.

OTHER BROADCAST FACILITIES

A brief analysis was completed to determine the presence of stations in the vicinity of the K20HB tower using data contained within The Commission's Consolidated Database System. One authorized FM radio station was found within 100 meters of the tower, one authorized NTSC translator was found within 100 meters, and a DTV and NTSC station were also found within 100 meters of the site in addition to the applicant's proposed K20HB facility. There are no AM stations within 3.22 kilometers of the proposed site. Although no adverse effects are expected due to the proposed changes to K20HB, the applicant will install filters or take other measures necessary to resolve any problems provided they are related to the changes proposed in this application.

The proposed site for K20HB is also the KTVQ(TV) site. Therefore, KTVQ(TV), licensed to operate at 100 kW ND ERP with a center of radiation of 104 meters AGL and KTVQ-DT, allotted operation of 1000 kW DA ERP with a center of radiation of 104 meters AGL are both located on the same existing tower in which K20HB proposes to operate. The FM filling KBBB(FM) is also licensed to operate from existing KTVQ site with a total ERP (horizontal and vertical) of 200 kW at a center of radiation of 76 meters AGL. The NTSC translator, K14IS, is licensed to operate at 9.66 kW ND ERP at a center of radiation of 33 meters AGL at a site 0.1 km from the proposed K20HB site.

Therefore, the radio frequency field ("RFF") study will consider the following stations:

KTVQ(TV) (according to the license)	Channel 2
KTVQ-DT (according to the CP)	Channel 17
KBBB-FM	Channel 279

K20HB
(proposed) Channel 20 (+)

K14IS Channel 14

The RF field 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 $\mu\text{W}/\text{cm}^2$

F = relative field factor

Total ERP = ERP Horizontal Polarization + ERP Vertical Polarization

R = RCAGL - 2 meters

ERP = RIMS ERP in watts for DTV Stations

ERP = $[0.4 \text{ ERP}_V + \text{ERP}_A]$ for NTSC Stations

ERP_V = peak visual ERP in watts

ERP_A = RIMS aural ERP in watts

KTVQ(TV) NTSC Facility

Channel 2 Freq: 54-60 MHz range
ERP = 50 kW(0.4) [100 kW(visual)]+[10 kW(aural)]
Polarization = Horizontal
RCAGL -2 meters = 102 meters

KTVQ(TV) utilizes an antenna with a field factor less than 0.2 at any angle greater than 45 degrees below the horizon. A value of 0.2 will be used in the calculation.

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

Tot ERP = 50000 watts (Horizontal Only)
R = 102 meters
F = 0.2 (field factor)

KTVQ(TV) contributes $6.4 \mu\text{W}/\text{cm}^2$ at 2 meters above ground.

The limit for an uncontrolled environment is $200 \mu\text{W}/\text{cm}^2$ for station broadcasting on 57 MHz.

Therefore:

KTVQ(TV) facility contributes 3.2% RFF for an uncontrolled environment two meters above ground at tower site.

KTVQ-DT DTV Facility

Channel 17 Freq: 192-198 MHz range
 ERP = 160 kW
 Polarization = Horizontal
 RCAGL -2 meters = 102 meters

KTVQ-DT utilizes a Dielectric, Type TW-12B10-R antenna with 1.0° electrical beam tilt. The manufacturer's vertical plane pattern for this antenna ensures that the field factor will be less than 0.1 at any angle greater than 20 degrees below the horizon. A value of 0.1 will be used in the calculation.

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

Tot ERP = 160 kW (Horizontal Only)
 R = 102 meters
 F = 0.1 (field factor)

KTVQ-DT contributes 5.1 $\mu\text{W}/\text{cm}^2$ at 2 meters above ground.
 The limit for an uncontrolled environment is 200 $\mu\text{W}/\text{cm}^2$ for station broadcasting on 195 MHz.

Therefore:

KTVQ-DT DTV facility contributes 2.6% RFF for an uncontrolled environment two meters above ground at tower site

KBBB-FM FM Facility

Channel 279C1 Freq: 103.5-103.9 MHz range
 ERP = 200 kW
 Polarization = Horizontal + Vertical
 RCAGL -2 meters = 74 meters

KBBB-FM utilizes an antenna with a vertical plane pattern that has a field factor less than 0.3 at any angle greater than 45 degrees below the horizon. A value of 0.3 will be used in the calculation.

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

Tot ERP = 200 kW (H+V)
 R = 74 meters
 F = 0.3 (field factor)

$$S = 109.8 \mu\text{W}/\text{cm}^2$$

KBBB-FM contributes 109.8 $\mu\text{W}/\text{cm}^2$ at 2 meters above ground.
 The limit for an uncontrolled environment is 200 $\mu\text{W}/\text{cm}^2$ for station broadcasting on 103.7 MHz.

Therefore:

KBBB-FM/FM facility contributes 54.9% RFF for an uncontrolled environment two meters above ground at tower site

K14IS TX Facility

Channel 14 Freq: 470-476 MHz range
 ERP = 9.66 kW
 Polarization = Horizontal
 RCAGL -2 meters = 31 meters

K14IS is assumed to have a field factor less than 0.2 at any angle greater than 45 degrees below the horizon. A value of 0.2 will be used in the calculation.

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

Tot ERP = 9.66 kW (Horizontal Only)
 R = 31 meters
 F = 0.2 (field factor)

$$S = 13.4 \mu\text{W}/\text{cm}^2$$

K14IS (TX) contributes $13.4 \mu\text{W}/\text{cm}^2$ at 2 meters above ground.
 The limit for an uncontrolled environment is $f/1500$ for station broadcasting on 473 MHz.

$$(473 \text{ MHz})/1500 = 315.3 \mu\text{W}/\text{cm}^2 \text{ is the RFF limit for K14IS (TX).}$$

Therefore:

K14IS TX facility contributes 4.3% RFF for an uncontrolled environment two meters above ground at tower site

K20HB TX Facility

Channel 20 (+) Freq: 506-512 MHz range
 ERP = 58.0 kW
 Polarization = Horizontal
 RCAGL -2 meters = 43 meters

K20HB (TX) proposes to utilize a Dielectric, Type TLP-16B antenna with 1.0° electrical beam tilt. The manufacturer's vertical plane pattern for the antenna is included at Exhibit E-2c. Based on this plot, the field factor will be less than 0.2 at any angle greater than 10 degrees below the horizon. A value of 0.2 will be used in the calculation.

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

Tot ERP = 58.0 kW (Horizontal Only)
 R = 43 meters
 F = 0.2 (field factor)

$$S = 41.9 \mu\text{W}/\text{cm}^2$$

K20HB (TX) contributes $41.9 \mu\text{W}/\text{cm}^2$ at 2 meters above ground.
The limit for an uncontrolled environment is $f/1500$ for station broadcasting on 509 MHz.

$(509 \text{ MHz})/1500 = 339.3 \mu\text{W}/\text{cm}^2$ is the RFF limit for K20HB(TX).

Therefore:

K20HB (TX) TX facility contributes 12.3% RFF for an uncontrolled environment two meters above ground at tower site

Total RFF at Site

The total RFF contribution for all transmitters can now be calculated:

Total RFF = 6.4 (TV) RFF + 5.1 (DT) RFF + 109.8 (FM) RFF + 13.4 (TX) RFF + 41.9 (TX) RFF = $176.6 \mu\text{W}/\text{cm}^2$

Total RFF = 3.2% + 2.6% + 54.9% + 4.3% + 12.3% = 77.3%

The total RFF contribution by the existing stations and the K20HB proposed DTV operations at 2 meters above ground level is 77.3% of the current FCC guidelines for general population exposure.

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.

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

- (a)(1) The existing facilities on an existing communications site are not located in an officially designated wilderness area.
- (a)(2) The existing facilities on an existing communications site are 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 proposed facilities are not located near any known Indian religious sites.
- (a)(6) The proposed facilities are not located in a flood plain.
- (a)(7) The operation of the proposed facilities on the 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 equip the tower with high intensity white lights unless required by the FAA.
- (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. A security fence with a locked gate restricts unauthorized access to the tower site.

ABOVE GROUND

ABOVE MEAN SEA LEVEL

116.7 METERS (382.9')

(4050.9') 1234.7 METERS

91.4 METERS (300')

C/R 45 METERS (147.6')

(3815.6') 1163 METERS C/R

*PAINTING AND LIGHTING
ARE IN ACORDANCE WITH
F.A.A. RULES AND REGULATIONS*

PROPOSED K20HB ANTENNA

TOWER REGISTRATION
No. 1001064

EXISTING GUYED TOWER

(NOT TO SCALE)

0.0 METERS (0')

(3668.0') 1118 METERS

EXHIBIT E - 1
VERTICAL SKETCH
FOR THE PROPOSED OPERATION OF
K20HB, BILLINGS, MONTANA
CHANNEL 20 58 kW 113 METERS HAAT
AUGUST 2004

COHEN, DIPPELL AND EVERIST, P.C. Consulting Engineers Washington, D.C.

TABLE I
COMPUTED COVERAGE DATA
FOR PROPOSED TRANSLATOR OPERATION OF
K20HB, BILLINGS, MONTANA
CHANNEL 20 58 KW ERP 1163 METERS RCAMSL
AUGUST 2004

<u>Radial</u> N ° E, T	<u>Average*</u> <u>Elevation</u> <u>3.2 to 16.1 km</u> meters	<u>Effective</u> <u>Height</u> meters	<u>Depression</u> <u>Angle</u> degrees	<u>ERP</u> kW	<u>Distance to Contour</u> <u>(74 dBu)</u> km
0	993.5	169.5	0.361	25.3	24.4
10	964.0	199.0	0.391	22.0	25.3
20	951.6	211.4	0.403	19.8	25.4
30	953.9	209.1	0.401	18.8	25.0
40	995.2	167.8	0.359	19.0	22.8
50	1039.1	123.9	0.308	19.9	19.8
60	1058.9	104.1	0.283	21.4	18.4
70	1051.6	111.4	0.292	22.7	19.5
80	1067.0	96.0	0.271	23.8	18.1
90	1081.3	81.7	0.250	24.1	16.4
100	1088.6	74.4	0.239	23.8	15.4
110	1094.4	68.6	0.229	23.1	14.7
120	1093.0	70.0	0.232	21.8	14.6
130	1105.7	57.3	0.210	20.4	13.0
140	1096.2	66.8	0.226	19.4	13.8
150	1103.7	59.3	0.213	18.9	13.0
160	1103.7	59.3	0.213	19.5	13.1
170	1123.1	39.9	0.175	21.7	11.0
180	1122.2	40.8	0.177	24.5	11.4
190	1107.7	55.3	0.206	28.3	13.9
200	1100.2	62.8	0.219	33.3	15.5
210	1094.4	68.6	0.229	38.7	17.1
220	1076.8	86.2	0.257	43.8	20.1
230	1036.7	126.3	0.311	48.5	24.8
240	964.0	199.0	0.391	52.2	30.2
250	968.0	195.0	0.387	55.1	30.2
260	975.8	187.2	0.379	57.1	30.0
270	981.4	181.6	0.373	58.0	29.7
280	991.6	171.4	0.363	57.4	29.0

TABLE I
COMPUTED COVERAGE DATA
FOR PROPOSED TRANSLATOR OPERATION OF
K20HB, BILLINGS, MONTANA
CHANNEL 20 58 KW ERP 1163 METERS RCAMSL
AUGUST 2004
 (continued)

	Average*				
	Elevation	Effective	Depression		Distance to Contour
<u>Radial</u>	<u>3.2 to 16.1 km</u>	<u>Height</u>	<u>Angle</u>	<u>ERP</u>	<u>(74 dBu)</u>
N ° E, T	meters	meters	degrees	kW	km
290	1046.7	116.3	0.299	55.7	24.7
300	1059.0	104.0	0.282	52.9	23.2
310	1043.8	119.2	0.302	49.0	24.2
320	1029.3	133.7	0.320	44.5	24.8
330	1013.8	149.2	0.338	39.6	25.4
340	988.8	174.2	0.366	34.4	26.3
350	990.8	172.2	0.364	29.6	25.4

*Based on data from FCC 3-second data base

NTSC Channel 20 (506-512 MHz)
 Average Elevation 3.2 to 16.1 km 1043.2 meters AMSL
 Center of Radiation 1163 meters AMSL
 Antenna Height Above Average Terrain 113 meters
 Effective Radiated Power 58 kW (17.63 dBk) Max.

North Latitude: 45° 46' 00"
 West Longitude: 108° 27' 27"

NAD-27

COHEN, DIPPELL AND EVERIST, P. C.

TABLE II
LONGLEY-RICE ANALYSIS FOR THE
PROPOSED OPERATION OF
K20HB, BILLINGS, MONTANA
CHANNEL 20 58 KW ERP 1163 METERS RCAMSL
AUGUST 2004

<u>Channel</u>	<u>Call</u>	<u>City/State</u>	<u>Dist(km)</u>	<u>Status</u>	<u>Application Ref. No.</u>		<u>Result</u>
16	K16DZ	HARDIN MT	71.5	LIC	BLTT	-19950515IC	No Interference
19	K19CO	EMIGRANT MT	180.2	LIC	BLTT	-19911118JH	No Interference
20	950306KF	IDAHO FALLS ID	354.9	CP	BPCT	-19950306KF	No Interference
20	K20DY	BELGRADE, ETC. MT	218.5	LIC	BLTTL	-19921116IF	No Interference
20	K20DY	BELGRADE, ETC. MT	218.5	CP	BPTTL	-20020207ABJ	No Interference
20	K20BP	PHILLIPS COUNTY MT	241.5	LIC	BLTT	-19890313IR	No Interference
20	KFNB	CASPER WY	377	LIC	BLCT	-19950928KF	No Interference
23	K23HI	BILLINGS MT	6.4	CP	BNPTTL	-20000829AFB	No Interference
27	K27DL	EMIGRANT MT	180.2	LIC	BLTT	-19901226IX	No Interference
27	K27HQ	CODY WY	151.4	CP	BNPTTL	-20000831BKA	No Interference

EXHIBIT E-2

ANTENNA MANUFACTURER DATA

K20HB, BILLINGS, MONTANA



Date	Aug 2004	Channel	20
Call Letters	K20HB		
Location	Billings, MT		
Customer	Montana State University		
Antenna Type	TLP-16B		

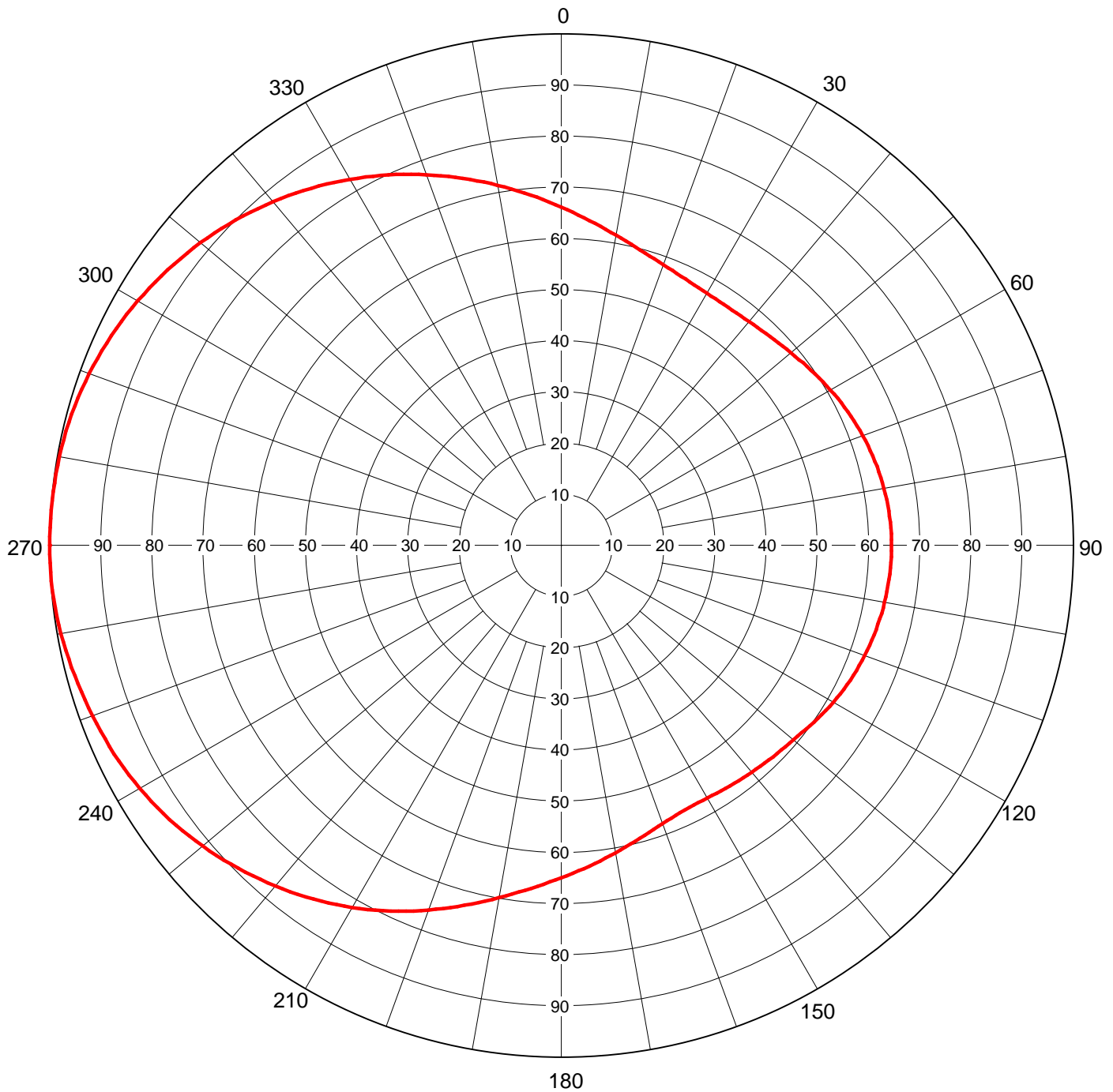
AZIMUTH PATTERN

Gain
Calculated / Measured

1.70 (2.30 dB)
Calculated

Frequency
Drawing #

509 MHz
TLP-B



Remarks:



Date	Aug 2004	
Call Letters	K20HB	Channel 20
Location	Billings, MT	
Customer	Montana State University	
Antenna Type	TLP-16B	

TABULATION OF AZIMUTH PATTERN

Azimuth Pattern Drawing # **TLP-B**

Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
0	0.661	45	0.577	90	0.645	135	0.584	180	0.650	225	0.893	270	1.000	315	0.899
1	0.656	46	0.578	91	0.645	136	0.583	181	0.654	226	0.897	271	1.000	316	0.895
2	0.651	47	0.580	92	0.645	137	0.582	182	0.659	227	0.902	272	0.999	317	0.890
3	0.646	48	0.582	93	0.645	138	0.581	183	0.663	228	0.906	273	0.999	318	0.886
4	0.641	49	0.584	94	0.645	139	0.580	184	0.668	229	0.910	274	0.999	319	0.881
5	0.637	50	0.586	95	0.644	140	0.579	185	0.673	230	0.914	275	0.998	320	0.876
6	0.632	51	0.588	96	0.644	141	0.578	186	0.678	231	0.919	276	0.998	321	0.872
7	0.628	52	0.590	97	0.643	142	0.577	187	0.683	232	0.923	277	0.998	322	0.867
8	0.624	53	0.592	98	0.643	143	0.576	188	0.688	233	0.927	278	0.997	323	0.862
9	0.619	54	0.594	99	0.642	144	0.575	189	0.694	234	0.930	279	0.996	324	0.857
10	0.615	55	0.596	100	0.641	145	0.574	190	0.699	235	0.934	280	0.996	325	0.852
11	0.612	56	0.598	101	0.640	146	0.573	191	0.705	236	0.938	281	0.995	326	0.847
12	0.608	57	0.600	102	0.640	147	0.572	192	0.711	237	0.941	282	0.994	327	0.842
13	0.604	58	0.603	103	0.639	148	0.572	193	0.716	238	0.944	283	0.993	328	0.836
14	0.601	59	0.605	104	0.638	149	0.571	194	0.722	239	0.948	284	0.992	329	0.831
15	0.597	60	0.607	105	0.637	150	0.570	195	0.728	240	0.951	285	0.990	330	0.826
16	0.594	61	0.609	106	0.636	151	0.570	196	0.734	241	0.954	286	0.989	331	0.820
17	0.591	62	0.611	107	0.634	152	0.570	197	0.740	242	0.956	287	0.987	332	0.815
18	0.589	63	0.614	108	0.633	153	0.570	198	0.747	243	0.959	288	0.985	333	0.810
19	0.586	64	0.616	109	0.632	154	0.570	199	0.753	244	0.962	289	0.983	334	0.804
20	0.583	65	0.618	110	0.631	155	0.571	200	0.759	245	0.964	290	0.981	335	0.799
21	0.581	66	0.619	111	0.629	156	0.572	201	0.765	246	0.966	291	0.979	336	0.793
22	0.579	67	0.621	112	0.628	157	0.573	202	0.771	247	0.968	292	0.977	337	0.787
23	0.577	68	0.623	113	0.626	158	0.575	203	0.777	248	0.971	293	0.975	338	0.782
24	0.575	69	0.625	114	0.625	159	0.577	204	0.783	249	0.973	294	0.972	339	0.776
25	0.574	70	0.627	115	0.623	160	0.579	205	0.789	250	0.975	295	0.970	340	0.771
26	0.573	71	0.628	116	0.621	161	0.581	206	0.795	251	0.977	296	0.967	341	0.765
27	0.571	72	0.630	117	0.619	162	0.584	207	0.801	252	0.979	297	0.964	342	0.759
28	0.570	73	0.632	118	0.618	163	0.587	208	0.806	253	0.980	298	0.961	343	0.754
29	0.569	74	0.633	119	0.616	164	0.590	209	0.812	254	0.982	299	0.958	344	0.748
30	0.569	75	0.634	120	0.613	165	0.593	210	0.817	255	0.984	300	0.955	345	0.742
31	0.568	76	0.636	121	0.611	166	0.596	211	0.823	256	0.986	301	0.952	346	0.737
32	0.568	77	0.637	122	0.609	167	0.600	212	0.828	257	0.988	302	0.949	347	0.731
33	0.568	78	0.638	123	0.607	168	0.603	213	0.834	258	0.990	303	0.946	348	0.726
34	0.568	79	0.639	124	0.605	169	0.607	214	0.839	259	0.991	304	0.942	349	0.720
35	0.568	80	0.640	125	0.602	170	0.610	215	0.844	260	0.993	305	0.939	350	0.714
36	0.568	81	0.641	126	0.600	171	0.614	216	0.849	261	0.994	306	0.935	351	0.709
37	0.569	82	0.642	127	0.598	172	0.618	217	0.854	262	0.995	307	0.932	352	0.703
38	0.569	83	0.643	128	0.596	173	0.622	218	0.859	263	0.996	308	0.928	353	0.698
39	0.570	84	0.643	129	0.594	174	0.625	219	0.864	264	0.997	309	0.924	354	0.692
40	0.571	85	0.644	130	0.592	175	0.629	220	0.869	265	0.998	310	0.920	355	0.687
41	0.572	86	0.644	131	0.590	176	0.633	221	0.874	266	0.999	311	0.916	356	0.682
42	0.573	87	0.645	132	0.589	177	0.637	222	0.879	267	0.999	312	0.912	357	0.676
43	0.574	88	0.645	133	0.587	178	0.641	223	0.883	268	0.999	313	0.908	358	0.671
44	0.575	89	0.645	134	0.586	179	0.646	224	0.888	269	1.000	314	0.904	359	0.666

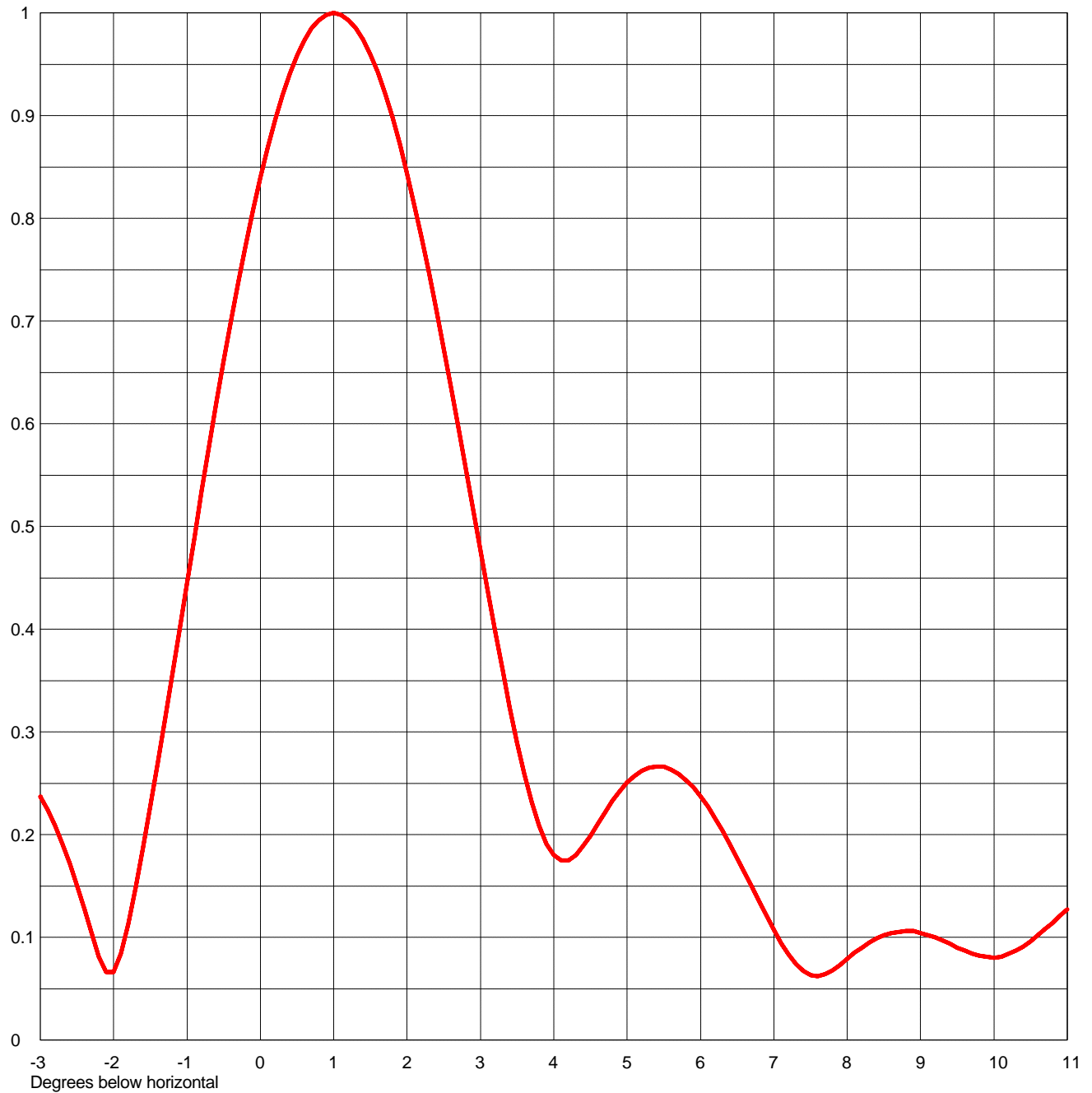
Remarks:



Date	Aug 2004	Channel	20
Call Letters	K20HB		
Location	Billings, MT		
Customer	Montana State University		
Antenna Type	TLP-16B		

ELEVATION PATTERN

RMS Gain at Main Lobe	16.0 (12.04 dB)	Beam Tilt	1.00 Degrees
RMS Gain at Horizontal	11.3 (10.53 dB)	Frequency	509.00 MHz
Calculated / Measured	Calculated	Drawing #	16L160100



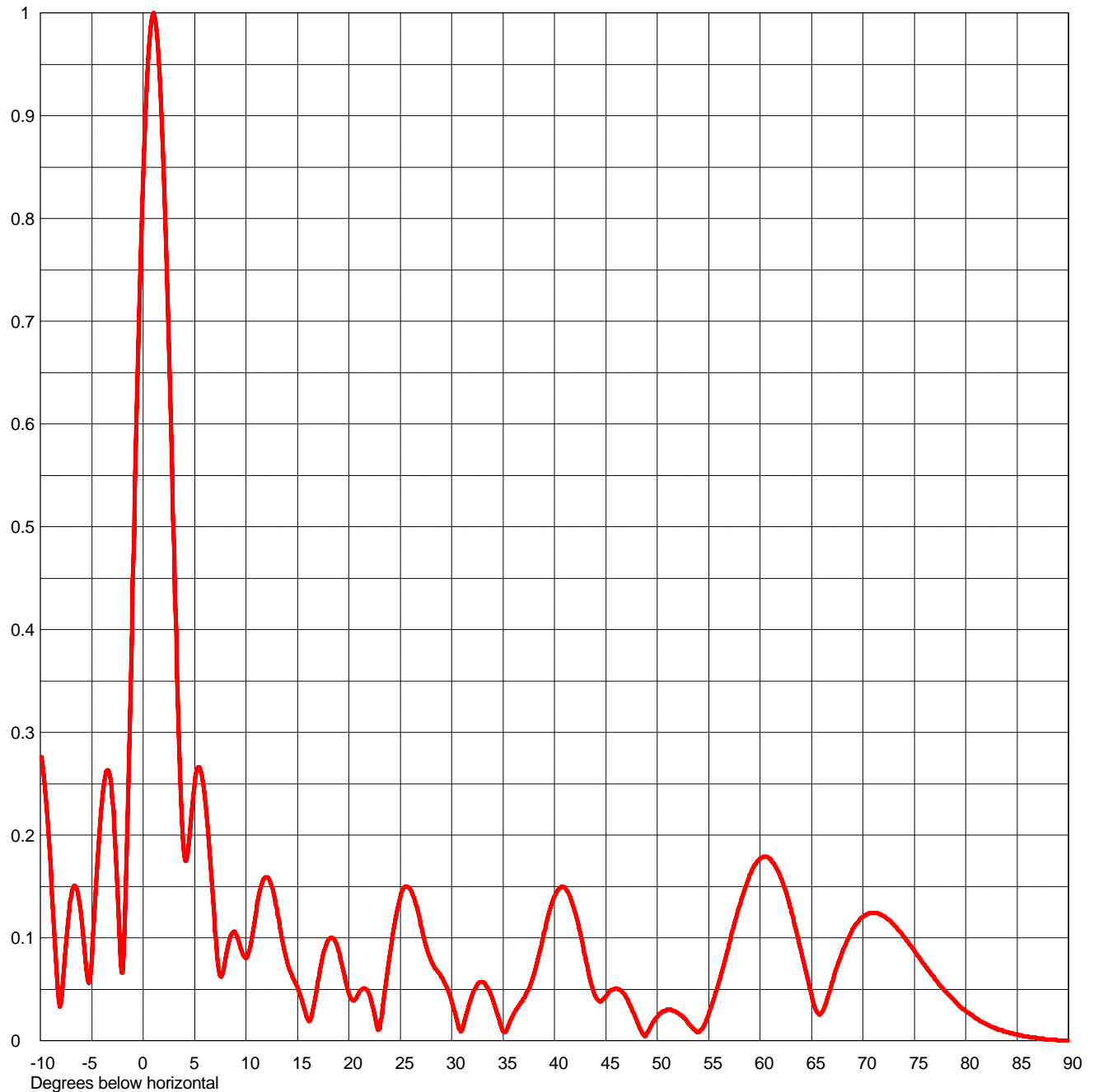
Remarks:



Date	Aug 2004	Channel	20
Call Letters	K20HB		
Location	Billings, MT		
Customer	Montana State University		
Antenna Type	TLP-16B		

ELEVATION PATTERN

RMS Gain at Main Lobe	16.0 (12.04 dB)	Beam Tilt	1.00 Degrees
RMS Gain at Horizontal	11.3 (10.53 dB)	Frequency	509.00 MHz
Calculated / Measured	Calculated	Drawing #	16L160100-90



Remarks:



Date	Aug 2004	Channel	20
Call Letters	K20HB		
Location	Billings, MT		
Customer	Montana State University		
Antenna Type	TLP-16B		

TABULATION OF ELEVATION PATTERN

Elevation Pattern Drawing # **16L160100-90**

Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.283	2.4	0.711	10.6	0.102	30.5	0.020	51.0	0.030	71.5	0.124
-9.5	0.238	2.6	0.635	10.8	0.114	31.0	0.010	51.5	0.029	72.0	0.121
-9.0	0.167	2.8	0.556	11.0	0.127	31.5	0.027	52.0	0.027	72.5	0.118
-8.5	0.083	3.0	0.476	11.5	0.151	32.0	0.044	52.5	0.023	73.0	0.113
-8.0	0.036	3.2	0.397	12.0	0.159	32.5	0.055	53.0	0.017	73.5	0.107
-7.5	0.096	3.4	0.324	12.5	0.150	33.0	0.057	53.5	0.012	74.0	0.101
-7.0	0.141	3.6	0.259	13.0	0.128	33.5	0.052	54.0	0.008	74.5	0.094
-6.5	0.149	3.8	0.209	13.5	0.100	34.0	0.040	54.5	0.014	75.0	0.087
-6.0	0.119	4.0	0.180	14.0	0.077	34.5	0.024	55.0	0.026	75.5	0.081
-5.5	0.066	4.2	0.175	14.5	0.062	35.0	0.009	55.5	0.040	76.0	0.074
-5.0	0.081	4.4	0.189	15.0	0.052	35.5	0.014	56.0	0.057	76.5	0.067
-4.5	0.163	4.6	0.211	15.5	0.038	36.0	0.025	56.5	0.075	77.0	0.060
-4.0	0.233	4.8	0.233	16.0	0.021	36.5	0.034	57.0	0.094	77.5	0.054
-3.5	0.263	5.0	0.251	16.5	0.030	37.0	0.041	57.5	0.113	78.0	0.048
-3.0	0.237	5.2	0.262	17.0	0.057	37.5	0.050	58.0	0.131	78.5	0.043
-2.8	0.209	5.4	0.266	17.5	0.083	38.0	0.064	58.5	0.147	79.0	0.038
-2.6	0.172	5.6	0.263	18.0	0.098	38.5	0.084	59.0	0.161	79.5	0.033
-2.4	0.127	5.8	0.253	18.5	0.099	39.0	0.105	59.5	0.171	80.0	0.029
-2.2	0.081	6.0	0.237	19.0	0.088	39.5	0.125	60.0	0.177	80.5	0.025
-2.0	0.066	6.2	0.216	19.5	0.067	40.0	0.140	60.5	0.179	81.0	0.022
-1.8	0.113	6.4	0.191	20.0	0.046	40.5	0.148	61.0	0.177	81.5	0.019
-1.6	0.187	6.6	0.163	20.5	0.039	41.0	0.149	61.5	0.170	82.0	0.016
-1.4	0.270	6.8	0.135	21.0	0.047	41.5	0.141	62.0	0.159	82.5	0.014
-1.2	0.357	7.0	0.107	21.5	0.051	42.0	0.125	62.5	0.145	83.0	0.012
-1.0	0.446	7.2	0.083	22.0	0.045	42.5	0.105	63.0	0.128	83.5	0.010
-0.8	0.534	7.4	0.067	22.5	0.025	43.0	0.081	63.5	0.108	84.0	0.008
-0.6	0.620	7.6	0.062	23.0	0.012	43.5	0.059	64.0	0.087	84.5	0.007
-0.4	0.700	7.8	0.068	23.5	0.047	44.0	0.043	64.5	0.065	85.0	0.006
-0.2	0.774	8.0	0.079	24.0	0.084	44.5	0.038	65.0	0.044	85.5	0.005
0.0	0.840	8.2	0.090	24.5	0.117	45.0	0.043	65.5	0.029	86.0	0.004
0.2	0.896	8.4	0.099	25.0	0.140	45.5	0.049	66.0	0.027	86.5	0.003
0.4	0.941	8.6	0.104	25.5	0.150	46.0	0.051	66.5	0.040	87.0	0.002
0.6	0.973	8.8	0.106	26.0	0.147	46.5	0.048	67.0	0.056	87.5	0.002
0.8	0.993	9.0	0.104	26.5	0.133	47.0	0.042	67.5	0.072	88.0	0.001
1.0	1.000	9.2	0.100	27.0	0.113	47.5	0.032	68.0	0.086	88.5	0.001
1.2	0.993	9.4	0.094	27.5	0.093	48.0	0.020	68.5	0.098	89.0	0.000
1.4	0.974	9.6	0.087	28.0	0.078	48.5	0.008	69.0	0.108	89.5	0.000
1.6	0.942	9.8	0.082	28.5	0.069	49.0	0.007	69.5	0.115	90.0	0.000
1.8	0.898	10.0	0.080	29.0	0.062	49.5	0.016	70.0	0.120		
2.0	0.844	10.2	0.084	29.5	0.053	50.0	0.023	70.5	0.123		
2.2	0.781	10.4	0.091	30.0	0.039	50.5	0.028	71.0	0.124		

Remarks:



SYSTEM SUMMARY

Antenna:

Type:	TLP-16B	ERP:	58.0 kW	(17.63 dBk)
Channel:	20	RMS Gain*:	16.0	(12.04 dB)
Location:	Billings, MT	Input Power:	3.63 kW	(5.59 dBk)

H Pol

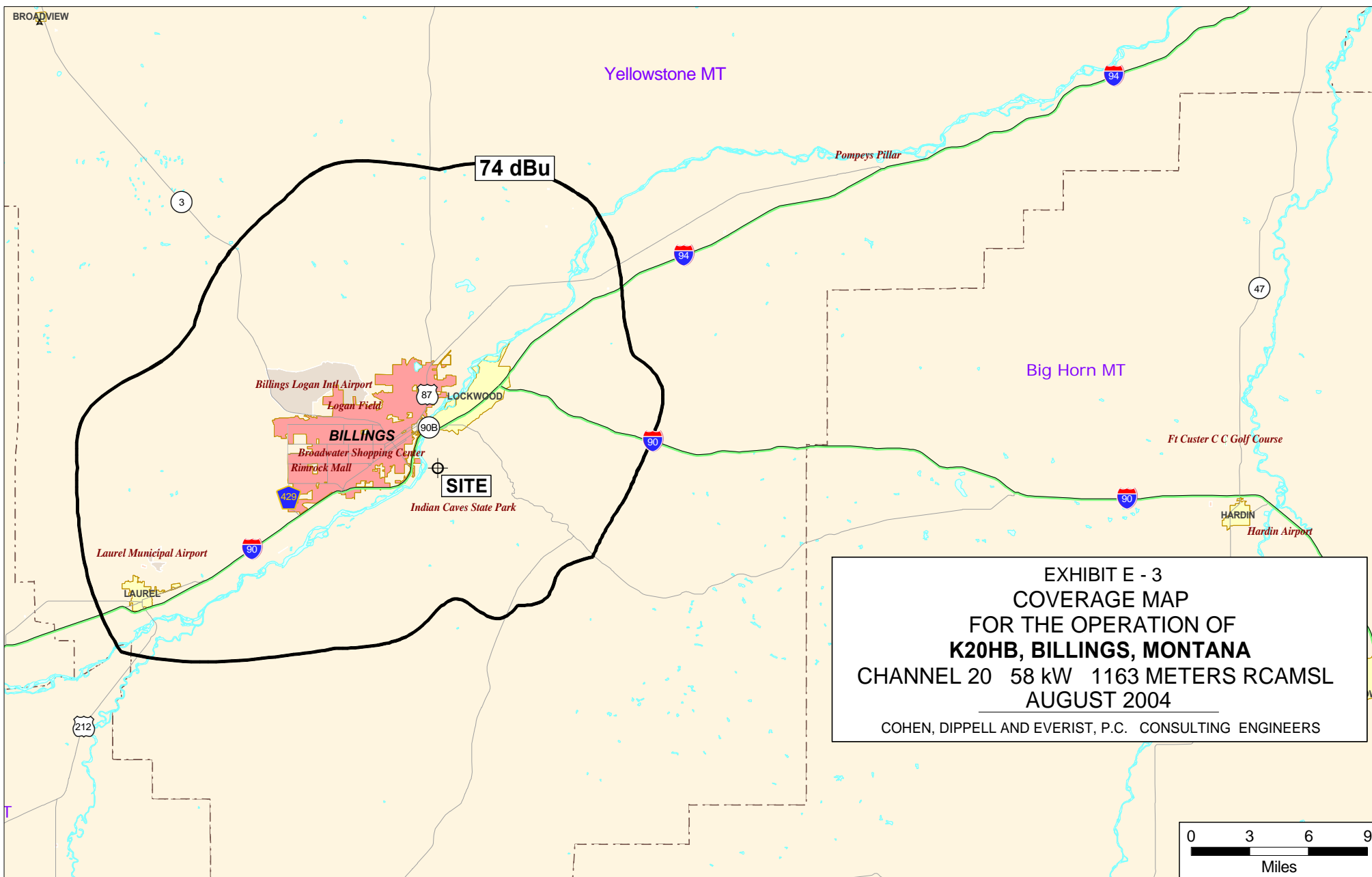
Transmission Line:

Type:	FLEXLine®	Attenuation:	1.40 dB
Size:	1-5/8" 50 ohm	Efficiency:	72.5%
Length	250 ft	76 m	

Transmitter:

Peak TV Power Required (10% Aural): **5.00 kW** (6.99 dBk)

* Gain is with respect to half wave dipole.



Section III - Engineering

TECHNICAL SPECIFICATIONS

Ensure that the specifications below are accurate. Contradicting data found elsewhere in this application will be disregarded. All items must be completed. The response "on file" is not acceptable.

TECH BOX

1. Channel: _____

2. Frequency Offset:

☐

No offset

☐

Zero offset

☐

Plus offset

☐

Minus offset

3. Translator Input Channel No. _____

4. Primary station proposed to be rebroadcast:

Call Sign	City	State	Channel
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5. Antenna Location Coordinates: (NAD 27)

_____ ° _____ ' _____ " ☐ N ☐ S Latitude
_____ ° _____ ' _____ " ☐ E ☐ W Longitude

6. Antenna Structure Registration Number: _____

☐

Not applicable

☐

FAA Notification Filed with FAA

7. Antenna Location Site Elevation Above Mean Sea Level: _____ meters

8. Overall Tower Height Above Ground Level: _____ meters

9. Height of Radiation Center Above Ground Level: _____ meters

10. Maximum Effective Radiated Power (ERP) Towards Radio Horizon: _____ kW

11. Maximum ERP in any Horizontal and Vertical Angle: _____ kW

12. Transmitting Antenna: ☐ Nondirectional ☐ Directional "Off-the-shelf" ☐ Directional composite

Manufacturer	Model
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Directional Antenna Relative Field Values:

Rotation: _____ ° ☐ No rotation ☐ N/A (Nondirectional)

Degree	Value	Degree	Value	Degree	Value	Degree	Value	Degree	Value	Degree	Value
0		60		120		180		240		300	
10		70		130		190		250		310	
20		80		140		200		260		320	
30		90		150		210		270		330	
40		100		160		220		280		340	
50		110		170		230		290		350	
Additional Azimuths											

NOTE: In addition to the information called for in this section, an explanatory exhibit providing full particulars must be submitted for each question for which a "No" response is provided.

CERTIFICATION

13. **Interference.** The proposed facility complies with all of the following applicable rule sections. Check all those that apply. ☐ Yes ☐ No See Explanation in Exhibit No.

TV broadcast analog system protection.

- a. ☐ 47 C.F.R. Section 74.705.

Digital TV station protection.

- b. ☐ 47 C.F.R. Section 74.706.

Low Power TV and TV translator station protection.

- c. ☐ 47 C.F.R. Section 74.707.

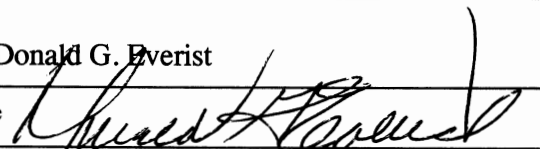
14. **Environmental Protection Act.** The proposed facility is excluded from environmental processing under 47 C.F.R. Section 1.1306 (*i.e.*, the facility will not have a significant environmental impact and complies with the maximum permissible radiofrequency electromagnetic exposure limits for controlled and uncontrolled environments). Unless the applicant can determine RF compliance. An **Exhibit is required.** ☐ Yes ☐ No See Explanation in Exhibit No.
- Exhibit No.

By checking "Yes" above, the applicant also certifies that it, in coordination with other users of the site, will reduce power or cease operation as necessary to protect persons having access to the site, tower or antenna from radiofrequency electromagnetic exposure in excess of FCC guidelines.

PREPARER'S CERTIFICATION ON PAGE 6 MUST BE COMPLETED AND SIGNED.

SECTION III PREPARER'S CERTIFICATION

I certify that I have prepared Section III (Engineering Data) on behalf of the applicant, and that after such preparation, I have examined and found it to be accurate and true to the best of my knowledge and belief.

Name Donald G. Everist		Relationship to Applicant (e.g., Consulting Engineer) Consulting Engineer	
Signature 		Date	
Mailing Address Cohen, Dippell and Everist, P.C., 1300 L Street, NW, Suite 1100			
City Washington		State or Country (if foreign address) DC	ZIP Code 20005
Telephone Number (include area code) (202) 898-0111		E-Mail Address (if available) cde@attglobal.net	

WILLFUL FALSE STATEMENTS ON THIS FORM ARE PUNISHABLE BY FINE AND/OR IMPRISONMENT (U.S. CODE, TITLE 18, SECTION 1001),
AND/OR REVOCATION OF ANY STATION LICENSE OR CONSTRUCTION PERMIT (U.S. CODE, TITLE 47, SECTION 312(a)(1)),
AND/OR FORFEITURE (U.S. CODE, TITLE 47, SECTION 503).