

K283CC 104.5 MHz Directional Antenna Approval Request

Attached, you will find:

1. A composite circular azimuth pattern generated by the measured vertical and horizontal azimuth patterns with proposed FCC pattern.
2. Horizontal and Vertical azimuth patterns of the proposed antenna measured on our antenna test range.
3. The RMS comparison of the measured azimuth pattern composite and the proposed azimuth pattern.

Upon review of these documents, I hereby accept the measured azimuth patterns and authorize Systems With Reliability to manufacture the custom directional translator antenna.

FCC File Number: BNPFT-20130909ACB
SWR Antenna Model: FMEC/1-PLUS-TA

Justin W. Asher

Consulting Engineer

Print Name

Title

Justin W. Asher

06/12/2014

Authorized Signature

Date

Please fax this signed sheet to 814-472-5552



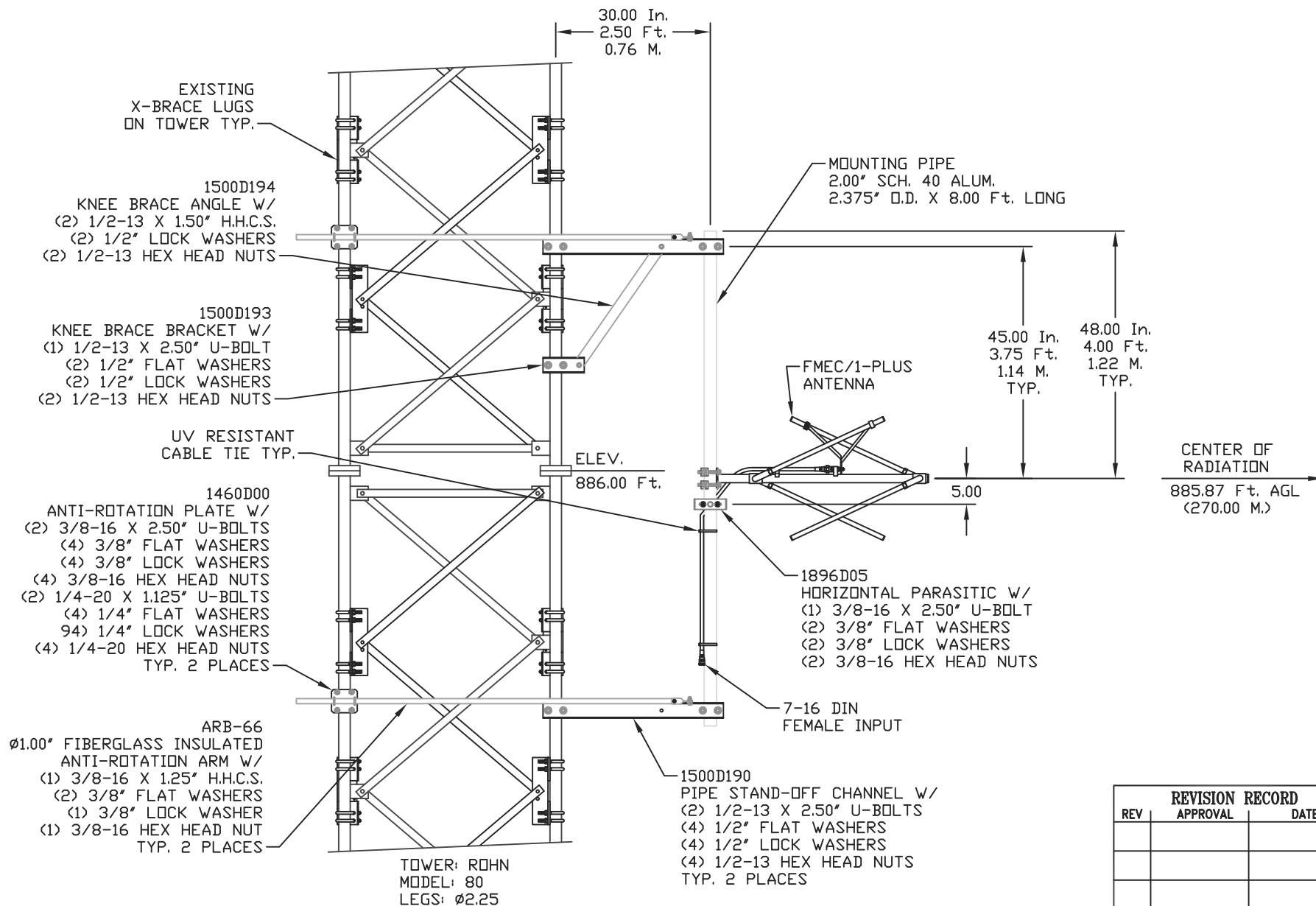
SYSTEMS WITH RELIABILITY
BROADCAST ANTENNAS AND TRANSMISSION LINE
FAX# 814-472-5552

NOTES:

1. REFERENCE DWG. 1896D01 FOR ANTENNA ORIENTATION.
2. REFERENCE DWG. 1896D02 FOR PARASITIC PLACEMENT.

DRAWING
NUMBER:

1896D00



SYSTEMS WITH RELIABILITY, LP
619 INDUSTRIAL PARK ROAD
EBensburg, PENNSYLVANIA 15931

TITLE:

FMEC/1-PLUS-TA, FREQ. 104.5
K283CC, DES MOINES, IA

MATERIAL:

SIZE

A

PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: RAC

DATE: 5/19/14

SHEET 1 OF 1

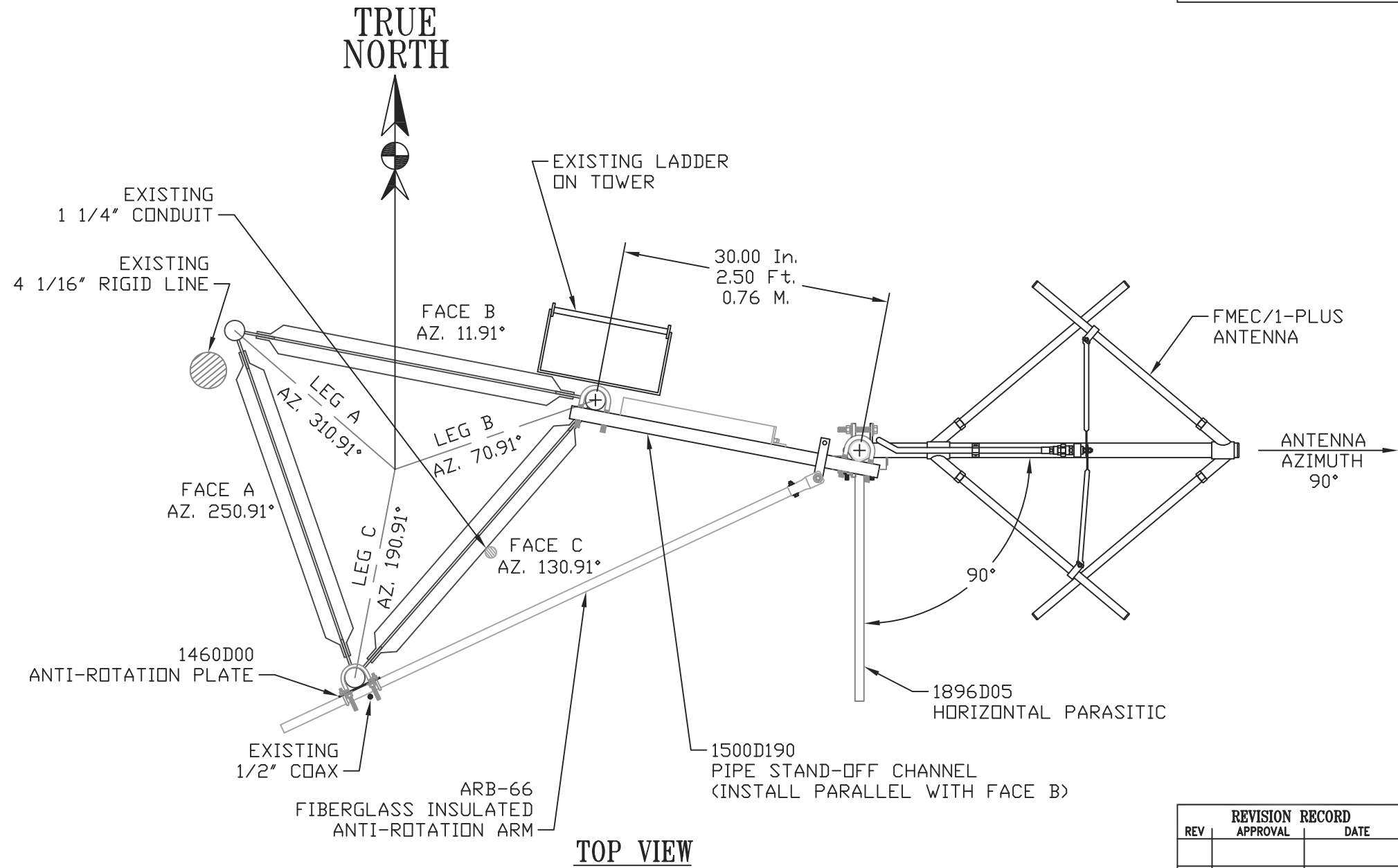
REVISION RECORD

REV	APPROVAL	DATE

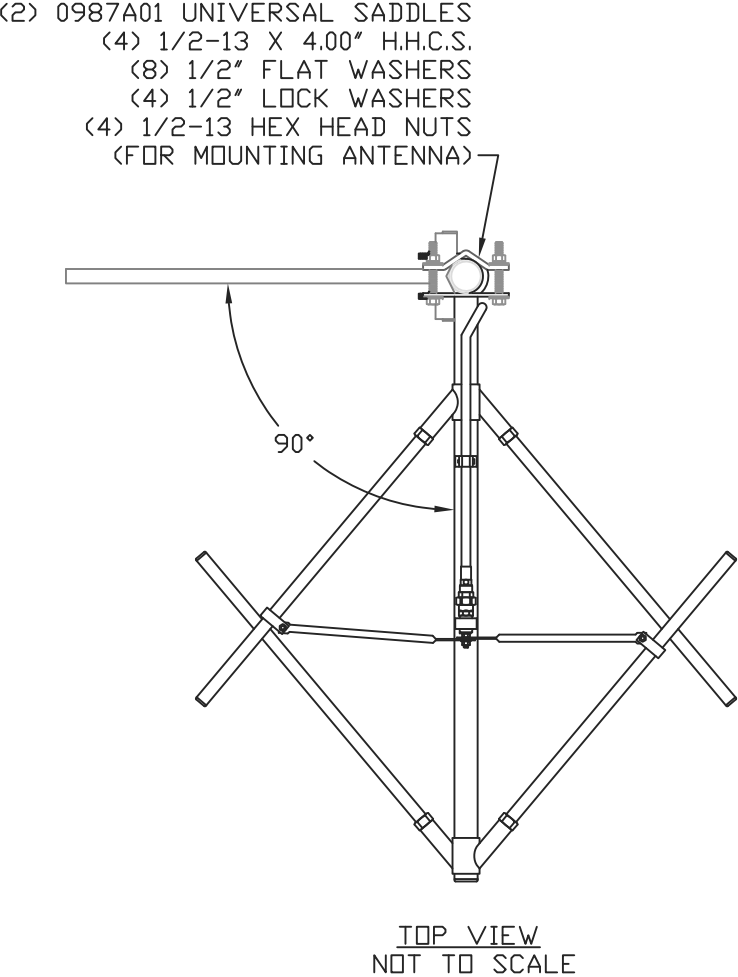
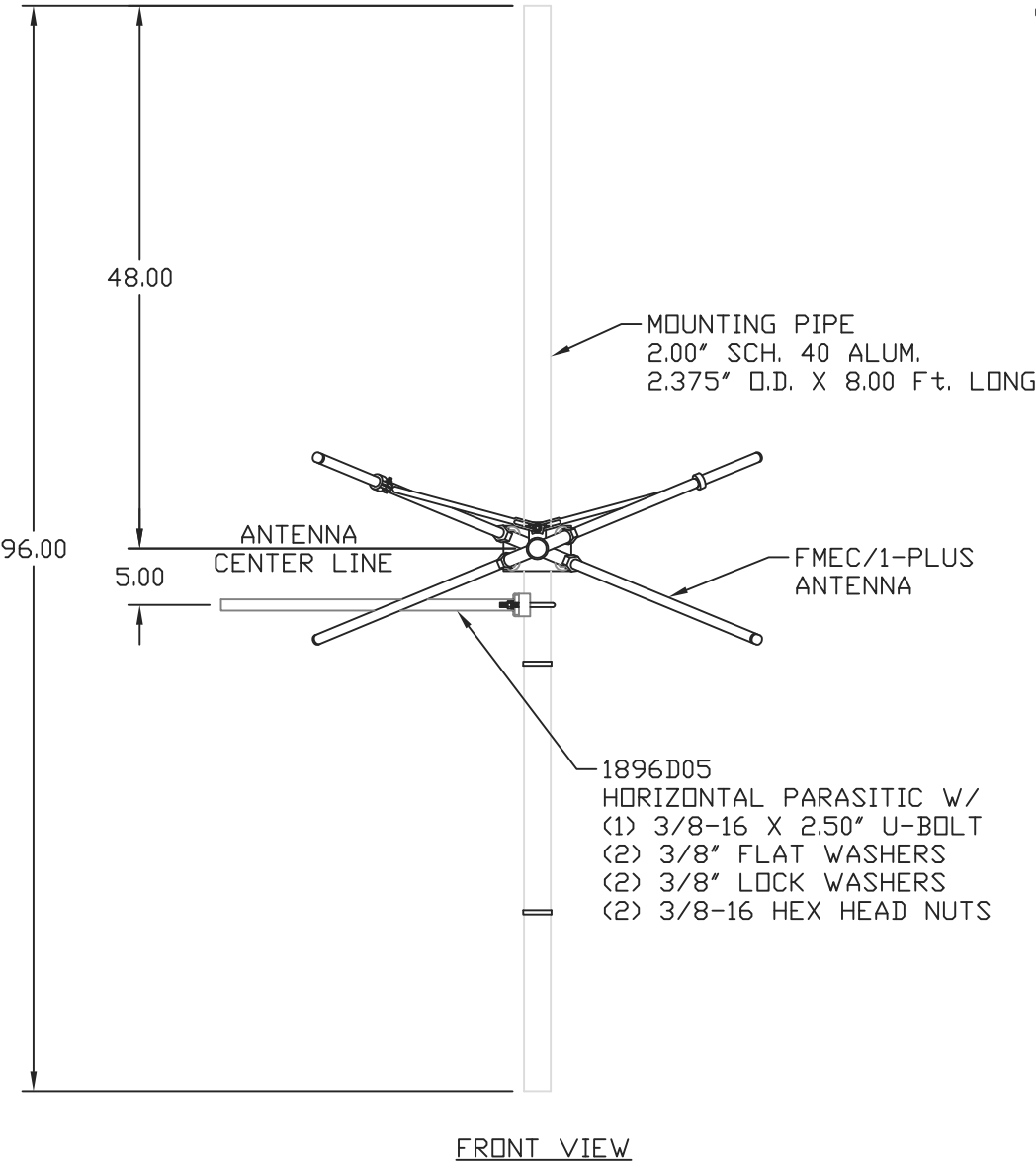
DRAWING
NUMBER:

1896D00

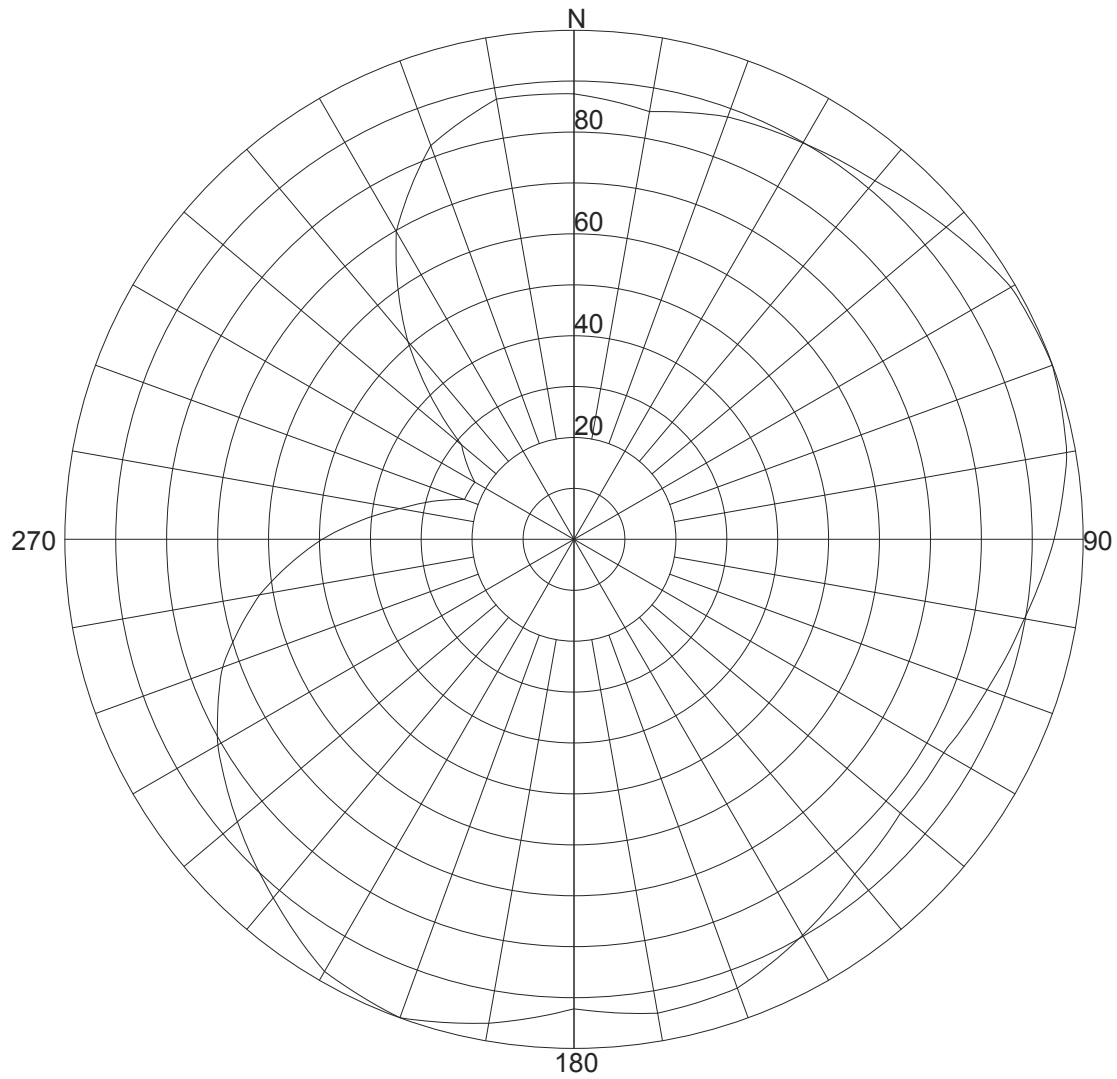
NOTE:



NOTE:



REVISION RECORD		
REV	APPROVAL	DATE



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability LP

CLIENT: K283CC

Date: 5/7/2014

ANTENNA TYPE: FMEC/1-PLUS-TA

FREQUENCY: 104.5 MHz

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.46513 / 1.66dB

PATTERN RMS: 0.826

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	.8750 (-1.15)	180	.9220 (-0.7)
5	.8640 (-1.26)	185	.9435 (-0.5)
10	.8530 (-1.37)	190	.9650 (-0.3)
15	.8680 (-1.22)	195	.9825 (-0.14)
20	.8830 (-1.07)	200	1.0000 (0.01)
25	.8910 (-0.99)	205	.9900 (-0.08)
30	.8990 (-0.92)	210	.9800 (-0.17)
35	.9090 (-0.82)	215	.9495 (-0.44)
40	.9190 (-0.72)	220	.9190 (-0.72)
45	.9365 (-0.56)	225	.8910 (-0.99)
50	.9540 (-0.4)	230	.8630 (-1.27)
55	.9725 (-0.23)	235	.8355 (-1.55)
60	.9910 (-0.07)	240	.8080 (-1.84)
65	.9955 (-0.03)	245	.7715 (-2.24)
70	1.0000 (0.01)	250	.7350 (-2.66)
75	.9915 (-0.07)	255	.6810 (-3.32)
80	.9830 (-0.14)	260	.6270 (-4.04)
85	.9630 (-0.32)	265	.5610 (-5.01)
90	.9430 (-0.5)	270	.4950 (-6.09)
95	.9205 (-0.71)	275	.4210 (-7.49)
100	.8980 (-0.92)	280	.3470 (-9.17)
105	.8805 (-1.1)	285	.2880 (-10.78)
110	.8630 (-1.27)	290	.2290 (-12.77)
115	.8505 (-1.4)	295	.2270 (-12.84)
120	.8380 (-1.52)	300	.2250 (-12.92)
125	.8375 (-1.53)	305	.2565 (-11.78)
130	.8370 (-1.54)	310	.2880 (-10.78)
135	.8475 (-1.43)	315	.3980 (-7.98)
140	.8580 (-1.32)	320	.5080 (-5.87)
145	.8780 (-1.12)	325	.6030 (-4.38)
150	.8980 (-0.92)	330	.6980 (-3.11)
155	.9180 (-0.73)	335	.7605 (-2.37)
160	.9380 (-0.55)	340	.8230 (-1.68)
165	.9415 (-0.51)	345	.8505 (-1.4)
170	.9450 (-0.48)	350	.8780 (-1.12)
175	.9335 (-0.59)	355	.8765 (-1.14)

Systems With Reliability LP

CLIENT: K283CC

Date: 5/7/2014

ANTENNA TYPE: FMEC/1-PLUS-TA

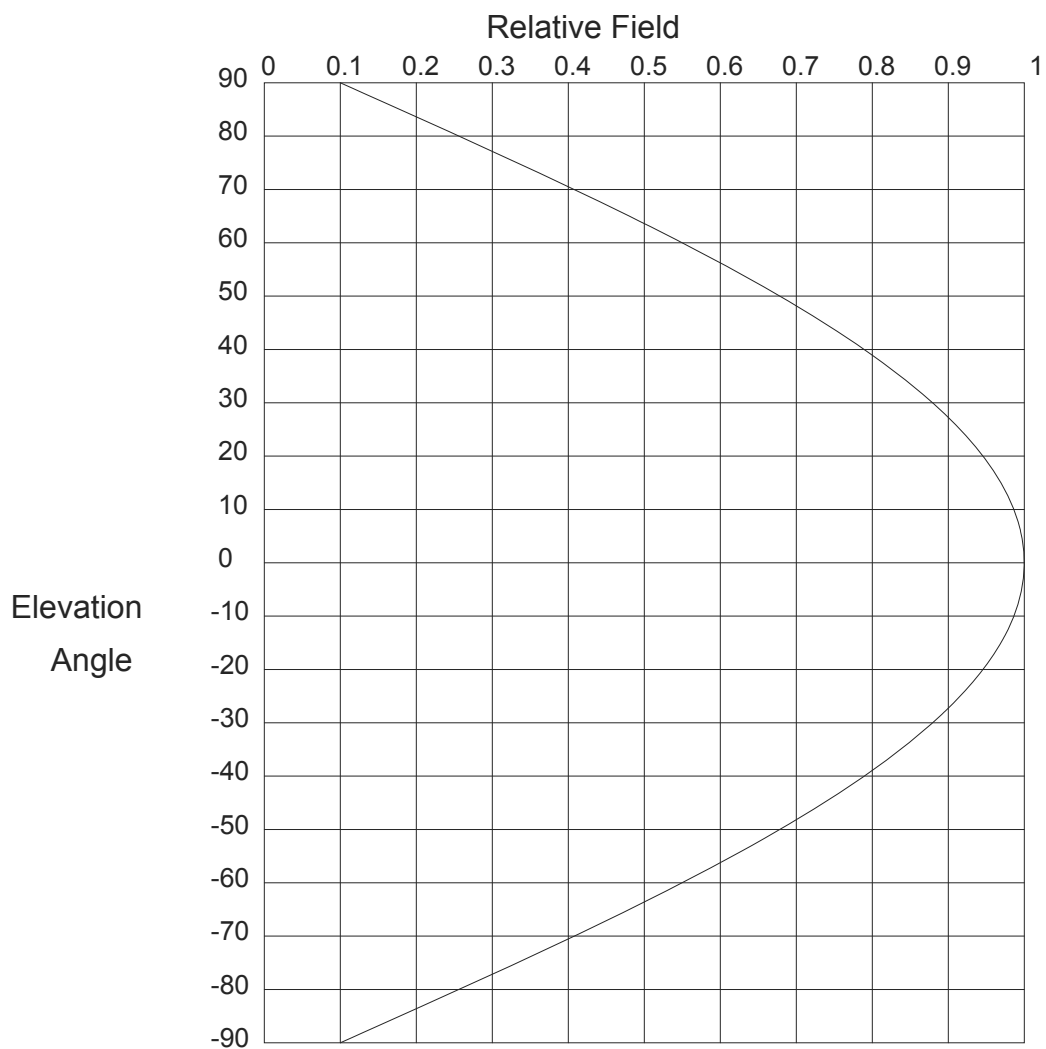
FREQUENCY: 104.5 MHz

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.46513 / 1.66dB

PATTERN RMS: 0.826



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability LP

CLIENT: *K283CC / Joe Farrington*

Date: 4/3/2014

ANTENNA TYPE: FMEC/1-PLUS-TA

FREQUENCY: 104.5 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 0.883/-0.539 dBd

Null Fill(s)(%) : 0, 0, 0

Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
90.0	.10 (-20)	52.0	.654 (-3.687)	14.0	.973 (-0.235)
89.0	.116 (-18.733)	51.0	.666 (-3.525)	13.0	.977 (-0.203)
88.0	.131 (-17.627)	50.0	.679 (-3.369)	12.0	.98 (-0.173)
87.0	.147 (-16.648)	49.0	.69 (-3.217)	11.0	.983 (-0.145)
86.0	.163 (-15.768)	48.0	.702 (-3.071)	10.0	.986 (-0.12)
85.0	.178 (-14.97)	47.0	.714 (-2.928)	9.8	.987 (-0.115)
84.0	.194 (-14.241)	46.0	.725 (-2.791)	9.6	.987 (-0.11)
83.0	.21 (-13.569)	45.0	.736 (-2.658)	9.4	.988 (-0.106)
82.0	.225 (-12.946)	44.0	.747 (-2.529)	9.2	.988 (-0.101)
81.0	.241 (-12.367)	43.0	.758 (-2.404)	9.0	.989 (-0.097)
80.0	.256 (-11.826)	42.0	.769 (-2.283)	8.8	.989 (-0.093)
79.0	.272 (-11.317)	41.0	.779 (-2.167)	8.6	.99 (-0.088)
78.0	.287 (-10.839)	40.0	.789 (-2.054)	8.4	.99 (-0.084)
77.0	.302 (-10.387)	39.0	.799 (-1.944)	8.2	.991 (-0.08)
76.0	.318 (-9.959)	38.0	.809 (-1.839)	8.0	.991 (-0.076)
75.0	.333 (-9.553)	37.0	.819 (-1.737)	7.8	.992 (-0.073)
74.0	.348 (-9.167)	36.0	.828 (-1.638)	7.6	.992 (-0.069)
73.0	.363 (-8.799)	35.0	.837 (-1.543)	7.4	.993 (-0.065)
72.0	.378 (-8.448)	34.0	.846 (-1.451)	7.2	.993 (-0.062)
71.0	.393 (-8.112)	33.0	.855 (-1.363)	7.0	.993 (-0.058)
70.0	.408 (-7.791)	32.0	.863 (-1.277)	6.8	.994 (-0.055)
69.0	.423 (-7.483)	31.0	.871 (-1.195)	6.6	.994 (-0.052)
68.0	.437 (-7.187)	30.0	.879 (-1.116)	6.4	.994 (-0.049)
67.0	.452 (-6.904)	29.0	.887 (-1.04)	6.2	.995 (-0.046)
66.0	.466 (-6.631)	28.0	.895 (-0.967)	6.0	.995 (-0.043)
65.0	.48 (-6.369)	27.0	.902 (-0.897)	5.8	.995 (-0.04)
64.0	.495 (-6.116)	26.0	.909 (-0.83)	5.6	.996 (-0.037)
63.0	.509 (-5.873)	25.0	.916 (-0.765)	5.4	.996 (-0.035)
62.0	.523 (-5.638)	24.0	.922 (-0.704)	5.2	.996 (-0.032)
61.0	.536 (-5.411)	23.0	.928 (-0.645)	5.0	.997 (-0.03)
60.0	.55 (-5.193)	22.0	.934 (-0.589)	4.8	.997 (-0.027)
59.0	.564 (-4.982)	21.0	.94 (-0.535)	4.6	.997 (-0.025)
58.0	.577 (-4.778)	20.0	.946 (-0.485)	4.4	.997 (-0.023)
57.0	.59 (-4.58)	19.0	.951 (-0.437)	4.2	.998 (-0.021)
56.0	.603 (-4.39)	18.0	.956 (-0.391)	4.0	.998 (-0.019)
55.0	.616 (-4.205)	17.0	.961 (-0.348)	3.8	.998 (-0.017)
54.0	.629 (-4.027)	16.0	.965 (-0.308)	3.6	.998 (-0.015)
53.0	.642 (-3.854)	15.0	.969 (-0.271)	3.4	.998 (-0.014)

Systems With Reliability LP

Page 1 of 3

CLIENT: K283CC / Joe Farrington

Date: 4/3/2014

ANTENNA TYPE: FMEC/1-PLUS-TA

FREQUENCY: 104.5 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 0.883/-0.539 dBd

Null Fill(s)(%) : 0, 0, 0

Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
3.2	.999 (-0.012)	-4.4	.997 (-0.023)	-12.0	.98 (-0.173)
3.0	.999 (-0.011)	-4.6	.997 (-0.025)	-12.2	.98 (-0.178)
2.8	.999 (-0.009)	-4.8	.997 (-0.027)	-12.4	.979 (-0.184)
2.6	.999 (-0.008)	-5.0	.997 (-0.03)	-12.6	.978 (-0.19)
2.4	.999 (-0.007)	-5.2	.996 (-0.032)	-12.8	.978 (-0.196)
2.2	.999 (-0.006)	-5.4	.996 (-0.035)	-13.0	.977 (-0.203)
2.0	.999 (-0.005)	-5.6	.996 (-0.037)	-13.2	.976 (-0.209)
1.8	1.00 (-0.004)	-5.8	.995 (-0.04)	-13.4	.975 (-0.215)
1.6	1.00 (-0.003)	-6.0	.995 (-0.043)	-13.6	.975 (-0.222)
1.4	1.00 (-0.002)	-6.2	.995 (-0.046)	-13.8	.974 (-0.229)
1.2	1.00 (-0.002)	-6.4	.994 (-0.049)	-14.0	.973 (-0.235)
1.0	1.00 (-0.001)	-6.6	.994 (-0.052)	-14.2	.973 (-0.242)
.8	1.00 (-0.001)	-6.8	.994 (-0.055)	-14.4	.972 (-0.249)
.6	1.00 (0)	-7.0	.993 (-0.058)	-14.6	.971 (-0.256)
.4	1.00 (0)	-7.2	.993 (-0.062)	-14.8	.97 (-0.263)
.2	1.00 (0)	-7.4	.993 (-0.065)	-15.0	.969 (-0.271)
.0	1.00 (0)	-7.6	.992 (-0.069)	-15.2	.969 (-0.278)
-.2	1.00 (0)	-7.8	.992 (-0.073)	-15.4	.968 (-0.285)
-.4	1.00 (0)	-8.0	.991 (-0.076)	-15.6	.967 (-0.293)
-.6	1.00 (0)	-8.2	.991 (-0.08)	-15.8	.966 (-0.3)
-.8	1.00 (-0.001)	-8.4	.99 (-0.084)	-16.0	.965 (-0.308)
-1.0	1.00 (-0.001)	-8.6	.99 (-0.088)	-16.2	.964 (-0.316)
-1.2	1.00 (-0.002)	-8.8	.989 (-0.093)	-16.4	.963 (-0.324)
-1.4	1.00 (-0.002)	-9.0	.989 (-0.097)	-16.6	.962 (-0.332)
-1.6	1.00 (-0.003)	-9.2	.988 (-0.101)	-16.8	.962 (-0.34)
-1.8	1.00 (-0.004)	-9.4	.988 (-0.106)	-17.0	.961 (-0.348)
-2.0	.999 (-0.005)	-9.6	.987 (-0.11)	-17.2	.96 (-0.357)
-2.2	.999 (-0.006)	-9.8	.987 (-0.115)	-17.4	.959 (-0.365)
-2.4	.999 (-0.007)	-10.0	.986 (-0.12)	-17.6	.958 (-0.374)
-2.6	.999 (-0.008)	-10.2	.986 (-0.124)	-17.8	.957 (-0.383)
-2.8	.999 (-0.009)	-10.4	.985 (-0.129)	-18.0	.956 (-0.391)
-3.0	.999 (-0.011)	-10.6	.985 (-0.134)	-18.2	.955 (-0.4)
-3.2	.999 (-0.012)	-10.8	.984 (-0.14)	-18.4	.954 (-0.409)
-3.4	.998 (-0.014)	-11.0	.983 (-0.145)	-18.6	.953 (-0.418)
-3.6	.998 (-0.015)	-11.2	.983 (-0.15)	-18.8	.952 (-0.427)
-3.8	.998 (-0.017)	-11.4	.982 (-0.156)	-19.0	.951 (-0.437)
-4.0	.998 (-0.019)	-11.6	.982 (-0.161)	-19.2	.95 (-0.446)
-4.2	.998 (-0.021)	-11.8	.981 (-0.167)	-19.4	.949 (-0.456)

Systems With Reliability LP

Page 2 of 3

CLIENT: K283CC / Joe Farrington

Date: 4/3/2014

ANTENNA TYPE: FMEC/1-PLUS-TA

FREQUENCY: 104.5 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 0.883/-0.539 dBd

Null Fill(s)(%) : 0, 0, 0

Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
-19.6	.948 (-0.465)	-27.2	.90 (-0.911)	-54.0	.629 (-4.027)
-19.8	.947 (-0.475)	-27.4	.899 (-0.924)	-55.0	.616 (-4.205)
-20.0	.946 (-0.485)	-27.6	.898 (-0.939)	-56.0	.603 (-4.39)
-20.2	.945 (-0.495)	-27.8	.896 (-0.953)	-57.0	.59 (-4.58)
-20.4	.944 (-0.505)	-28.0	.895 (-0.967)	-58.0	.577 (-4.778)
-20.6	.942 (-0.515)	-28.2	.893 (-0.981)	-59.0	.564 (-4.982)
-20.8	.941 (-0.525)	-28.4	.892 (-0.996)	-60.0	.55 (-5.193)
-21.0	.94 (-0.535)	-28.6	.89 (-1.01)	-61.0	.536 (-5.411)
-21.2	.939 (-0.546)	-28.8	.889 (-1.025)	-62.0	.523 (-5.638)
-21.4	.938 (-0.556)	-29.0	.887 (-1.04)	-63.0	.509 (-5.873)
-21.6	.937 (-0.567)	-29.2	.886 (-1.055)	-64.0	.495 (-6.116)
-21.8	.936 (-0.578)	-29.4	.884 (-1.07)	-65.0	.48 (-6.369)
-22.0	.934 (-0.589)	-29.6	.883 (-1.085)	-66.0	.466 (-6.631)
-22.2	.933 (-0.6)	-29.8	.881 (-1.101)	-67.0	.452 (-6.904)
-22.4	.932 (-0.611)	-30.0	.879 (-1.116)	-68.0	.437 (-7.187)
-22.6	.931 (-0.622)	-31.0	.871 (-1.195)	-69.0	.423 (-7.483)
-22.8	.93 (-0.633)	-32.0	.863 (-1.277)	-70.0	.408 (-7.791)
-23.0	.928 (-0.645)	-33.0	.855 (-1.363)	-71.0	.393 (-8.112)
-23.2	.927 (-0.656)	-34.0	.846 (-1.451)	-72.0	.378 (-8.448)
-23.4	.926 (-0.668)	-35.0	.837 (-1.543)	-73.0	.363 (-8.799)
-23.6	.925 (-0.68)	-36.0	.828 (-1.638)	-74.0	.348 (-9.167)
-23.8	.923 (-0.692)	-37.0	.819 (-1.737)	-75.0	.333 (-9.553)
-24.0	.922 (-0.704)	-38.0	.809 (-1.839)	-76.0	.318 (-9.959)
-24.2	.921 (-0.716)	-39.0	.799 (-1.944)	-77.0	.302 (-10.387)
-24.4	.92 (-0.728)	-40.0	.789 (-2.054)	-78.0	.287 (-10.839)
-24.6	.918 (-0.74)	-41.0	.779 (-2.167)	-79.0	.272 (-11.317)
-24.8	.917 (-0.753)	-42.0	.769 (-2.283)	-80.0	.256 (-11.826)
-25.0	.916 (-0.765)	-43.0	.758 (-2.404)	-81.0	.241 (-12.367)
-25.2	.914 (-0.778)	-44.0	.747 (-2.529)	-82.0	.225 (-12.946)
-25.4	.913 (-0.791)	-45.0	.736 (-2.658)	-83.0	.21 (-13.569)
-25.6	.912 (-0.803)	-46.0	.725 (-2.791)	-84.0	.194 (-14.241)
-25.8	.91 (-0.816)	-47.0	.714 (-2.928)	-85.0	.178 (-14.97)
-26.0	.909 (-0.83)	-48.0	.702 (-3.071)	-86.0	.163 (-15.768)
-26.2	.908 (-0.843)	-49.0	.69 (-3.217)	-87.0	.147 (-16.648)
-26.4	.906 (-0.856)	-50.0	.679 (-3.369)	-88.0	.131 (-17.627)
-26.6	.905 (-0.87)	-51.0	.666 (-3.525)	-89.0	.116 (-18.733)
-26.8	.903 (-0.883)	-52.0	.654 (-3.687)	-90.0	.10 (-20)
-27.0	.902 (-0.897)	-53.0	.642 (-3.854)	90.0	.00 (-50)

Systems With Reliability LP

Page 3 of 3

CLIENT: K283CC / Joe Farrington
 ANTENNA TYPE: FMEC/1-PLUS-TA
 FREQUENCY: 104.5 MHz
 PATTERN POL.: Circular
 DIRECTIVITY(Peak): 0.883/-0.539 dBd
 DIRECTIVITY(Horiz): 0.883/-0.539 dBd

Date: 4/3/2014

Beam Tilt (Deg.) : 0
 Null Fill(s)(%) : 0, 0, 0



SYSTEMS WITH RELIABILITY, INC.
Broadcast Antennas and Transmission Systems

K283CC Antenna RMS Comparison

PROPOSED ANTENNA

Azimuth Heading	Relative Field
0	1.000
10	1.000
20	1.000
30	1.000
40	1.000
50	1.000
60	1.000
70	1.000
80	1.000
90	1.000
100	1.000
110	1.000
120	1.000
130	1.000
140	1.000
150	1.000
160	1.000
170	1.000
180	1.000
190	1.000
200	1.000
210	1.000
220	1.000
230	1.000
240	1.000
250	1.000
260	1.000
270	0.560
280	0.500
290	0.560
300	1.000
310	1.000
320	1.000
330	1.000
340	1.000
350	1.000

Sum of Relative Field Squared : 33.877
Sum Divided by 36 (Readings) : 0.941
Square Root : 0.970

DESIGNED ANTENNA

Azimuth Heading	Relative Field
0	0.875
10	0.853
20	0.883
30	0.899
40	0.919
50	0.954
60	0.991
70	1
80	0.983
90	0.943
100	0.898
110	0.863
120	0.838
130	0.837
140	0.858
150	0.898
160	0.938
170	0.945
180	0.922
190	0.965
200	1
210	0.98
220	0.919
230	0.863
240	0.808
250	0.735
260	0.627
270	0.495
280	0.347
290	0.229
300	0.225
310	0.288
320	0.508
330	0.698
340	0.823
350	0.878

Sum of Relative Field Squared : 24.605
Sum Divided by 36 (Readings) : 0.683
Square Root : 0.827

Percentage of Construction Permit Antenna Filled :

85.2%