

An Inquiry into the Commission's Policies and Rules
Regarding AM Radio Service Directional Antenna
Performance Verification MM Docket 93-177

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- Traditional Full Proof-of-Performance
 - ~ 125 Page

- New Full Proof-of-Performance
 - ~ 40 Page

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This rulemaking provides these major simplifications to the “DA Proof” process:

- Reduction in the required number of measurement radials to as few as 6
- Reduction in the distance of measurements from 34 km to 15 km
- Reduction in the minimum number of total (DA and non-DA) measurement points from 18 to 15
- Elimination of the requirement for filing the measurement location maps

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Partial Proof of Performance Measurement Simplifications:

- Reduction of the total number of radials required to minimum of 4, including monitored radials and (if necessary) adjacent radials
- Reduction of total points per radial from 10 to 8
- If DA/non-DA measurements are appropriate, new points may be used

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Monitor Point Change Simplifications:

- If a point from the original proof is used, new measurements on that point
- If a new point is used, “partial proof” measurements on the affected radial
- No monitor point map required

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Most Importantly for the Future of AM Radio:

- The Commission issued a “Further Notice of Proposed Rulemaking on the Use of Computer Modeling to Predict Antenna Performance”

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The items in **BOLD** have all been required, because of a rule provision, because of a question in the 302 Form, or because the staff informally required them. Sometimes an applicant could skate one or more of them - we've submitted proofs without the maps and had them approved - and some (antenna impedance measurements) were required only because they had to kept on file by the licensee, but in general this is the "practical" minimum.



United States of America
FEDERAL COMMUNICATIONS COMMISSION
AM BROADCAST STATION CONSTRUCTION PERMIT

Authorizing Official:

Official Mailing Address:

Son Nguyen
Supervisory Engineer
Audio Services Division
Mass Media Bureau

Facility ID: _____

Call Sign: _____

Permit File Number: BP- _____

Grant Date: January 13, 2000

This permit expires 3:00 a.m.
local time, 36 months after the
grant date specified above.

Subject to the provisions of the Communications Act of 1934, as amended, subsequent acts and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions set forth in this permit, the permittee is hereby authorized to construct the radio transmitting apparatus herein described. Installation and adjustment of equipment not specifically set forth herein shall be in accordance with representations contained in the permittee's application for construction permit except for such modifications as are presently permitted, without application, by the Commission's Rules.

Commission rules which became effective on February 16, 1999, have a bearing on this construction permit. See Report & Order, Streamlining of Mass Media Applications, MM Docket No. 98-43, 13 FCC RCD 23056, Para. 77-90 (November 25, 1998); 63 Fed. Reg. 70039 (December 18, 1998). Pursuant to these rules, this construction permit will be subject to automatic forfeiture unless construction is complete and an application

Subject to the provisions of the Communications Act of 1934, as amended, subsequent acts and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions set forth in this permit, the permittee is hereby authorized to construct the radio transmitting apparatus herein described. Installation and adjustment of equipment not specifically set forth herein shall be in accordance with representations contained in the permittee's application for construction permit except for such modifications as are presently permitted, without application, by the Commission's Rules.

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Equipment and program tests shall be conducted only pursuant to Sections 73.1610 and 73.1620 of the Commission's Rules.

Hours of Operation: Unlimited

Average hours of sunrise and sunset:
Local Standard Time (Non-Advanced)

Jan.	7:15 AM	5:00 PM	Jul.	4:45 AM	7:15 PM
Feb.	6:45 AM	5:30 PM	Aug.	5:15 AM	6:45 PM
Mar.	6:15 AM	6:00 PM	Sep.	5:45 AM	6:00 PM
Apr.	5:30 AM	6:30 PM	Oct.	6:00 AM	5:15 PM
May	4:45 AM	7:00 PM	Nov.	6:30 AM	4:45 PM
Jun.	4:30 AM	7:15 PM	Dec.	7:00 AM	4:45 PM

Callsign: [REDACTED]

Permit No.: BP-[REDACTED]

Name of Permittee: [REDACTED]

Station Location: [REDACTED]

Frequency (kHz): [REDACTED]

Station Class: [REDACTED]

Antenna Coordinates:

Unlimited

Latitude: N [REDACTED] Deg [REDACTED] Min [REDACTED] Sec

Longitude: W [REDACTED] Deg [REDACTED] Min [REDACTED] Sec

Transmitter(s): Type Accepted. See Sections 73.1660, 73.1665 and 73.1670 of the Commission's Rules.

Nominal Power (kW): Unlimited:50.0

Antenna Mode: Unlimited:DA

(DA=Directional Antenna, ND=Non-directional Antenna; CH=Critical Hours)

Antenna Registration Number(s):

Unlimited:

Tower No.	ASRN
-----------	------

1	[REDACTED]
---	------------

2	[REDACTED]
---	------------

3	[REDACTED]
---	------------

4	[REDACTED]
---	------------

DESCRIPTION OF DIRECTIONAL ANTENNA SYSTEM

Theoretical RMS (mV/m/km): Unlimited:2586.8

Antenna Registration Number(s):

Unlimited:

Tower No.	ASRN
1	[REDACTED]
2	[REDACTED]
3	[REDACTED]
4	[REDACTED]

DESCRIPTION OF DIRECTIONAL ANTENNA SYSTEM

Theoretical RMS (mV/m/km): Unlimited:2586.8

Standard RMS (mV/m/km): Unlimited:2717.35

Augmented RMS (mV/m/km):

Q Factor: Unlimited:78.45

Theoretical Parameters:

Unlimited Directional Antenna:

Tower No.	Field Ratio	Phasing (Deg.)	Spacing (Deg.)	Orientation (Deg.)	Tower Switch *	Ref Height (Deg.)
1	1.0000	0.000	0.0000	0.000	0	178.3
2	0.8780	-19.100	172.0000	180.000	0	178.3
3	0.9890	82.000	215.0000	159.000	0	178.3
4	1.0000	101.900	100.0000	99.300	0	178.3

* Tower Reference Switch:

0 = Spacing and orientation from reference tower

1 = Spacing and orientation from previous tower

Inverse Distance Field Strength:

The inverse distance field strength at a distance of one kilometer from the above antenna in the directions specified shall not exceed the following values:

Unlimited :

Azimuth:	Radiation:	
20	409.3	mV/m
79.5	246.5	mV/m
125	550	mV/m
145	204.5	mV/m
339	171.7	mV/m

Special operating conditions or restrictions:

- 1 The permittee/licensee must reduce power or cease operation as necessary to protect persons having access to the site, tower or antenna from radiofrequency electromagnetic fields in excess of FCC guidelines.
- 2 A complete nondirectional proof of performance, in addition to a complete proof on the directional antenna system, shall be submitted before program tests are authorized. The nondirectional and directional field strength measurements must be made under similar environmental conditions.
- 3 Permittee shall install a type accepted transmitter, or submit application (FCC Form 301) along with data prescribed in Section 73.1660(b) should non-type accepted transmitter be proposed.
- 4 Operation by remote control authorized.

From: Tom Gorton
To: Ms. Ann Gallagher, FCC
Re: Permit BP-XXXX

Can you please clarify for me why two of the five azimuths specified on the above CP were chosen?

Specifically, the CP specifies a maximum on 20° , while the pattern null is 22.1° . Also, the specified 125° radial is on the shoulder of a minor lobe, not in the null or at a maximum.

Any clarification you can offer would be much appreciated!

Thomas S. Gorton P.E.
Hatfield & Dawson

From: Edward Lubetzky <ELUBETZK@fcc.gov>

To: Tom Gorton

Subject: Re: Permit BP-XXXX

Dear Mr Gorton:

The construction permit BP-XXXX has a typographical error in that it should have specified that the inverse distance field at 22.0 degrees (not 20 degrees) (rounded to the nearest 0.5 degree) should not exceed 409.3 mV/m.

The 125 degree monitor point direction was specified not at the maximum of the lobe but at a point where the shape of the lobe is being formed and monitored.

Please let me know how I can be of further assistance.

Edward Lubetzky

FCC

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

Station License

Direct Measurement of Power

1. Facilities authorized in construction permit

Call Sign	File No. of Construction Permit (if applicable)	Frequency (kHz)	Hours of Operation	Power in kilowatts	
				Night	Day

2. Station location

State	City or Town

3. Transmitter location

State	County	City or Town	Street address (or other identification)

4. Main studio location

State	County	City or Town	Street address (or other identification)

5. Remote control point location (specify only if authorized directional antenna)

State	County	City or Town	Street address (or other identification)

6. Has type-approved stereo generating equipment been installed?

Yes

No

7. Does the sampling system meet the requirements of 47 C.F.R. Section 73.68?

Yes

No

Not Applicable

Attach as an Exhibit a detailed description of the sampling system as installed.

Exhibit No.

8. Operating constants:

5. Remote control point location (specify only if authorized directional antenna)

State	County	City or Town	Street address (or other identification)
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6. Has type-approved stereo generating equipment been installed?

Yes No

7. Does the sampling system meet the requirements of 47 C.F.R. Section 73.68?

Yes No

Not Applicable

Attach as an Exhibit a detailed description of the sampling system as installed.

Exhibit No.

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system	RF common point or antenna current (in amperes) without modulation for day system
Measured antenna or common point resistance (in ohms) at operating frequency Night Day	Measured antenna or common point reactance (in ohms) at operating frequency Night Day

Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
	Night	Day	Night	Day	Night	Day

Manufacturer and type of antenna monitor:

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9. Description of antenna system ((f directional antenna is used, the information requested below should be given for each element of the array. Use separate sheets if necessary.)

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit. <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">Exhibit No.</div>
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Excitation Series Shunt

Geographic coordinates to nearest second. For directional antenna give coordinates of center of array. For single vertical radiator give tower location.

North Latitude	° ' "	West Longitude	° ' "
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If not fully described above, attach as an Exhibit further details and dimensions including any other antenna mounted on tower and associated isolation circuits.

Exhibit No.

Also, if necessary for a complete description, attach as an Exhibit a sketch of the details and dimensions of ground system.

Exhibit No.

10. In what respect, if any, does the apparatus constructed differ from that described in the application for construction permit or in the permit?

11. Give reasons for the change in antenna or common point resistance.

I certify that I represent the applicant in the capacity indicated below and that I have examined the foregoing statement of technical information and that it is true to the best of my knowledge and belief.

dimensions of ground system.

10. In what respect, if any, does the apparatus constructed differ from that described in the application for construction permit or in the permit?

11. Give reasons for the change in antenna or common point resistance.

I certify that I represent the applicant in the capacity indicated below and that I have examined the foregoing statement of technical information and that it is true to the best of my knowledge and belief.

Name (Please Print or Type)	Signature (check appropriate box below)
Address (include ZIP Code)	Date
	Telephone No. (Include Area Code)

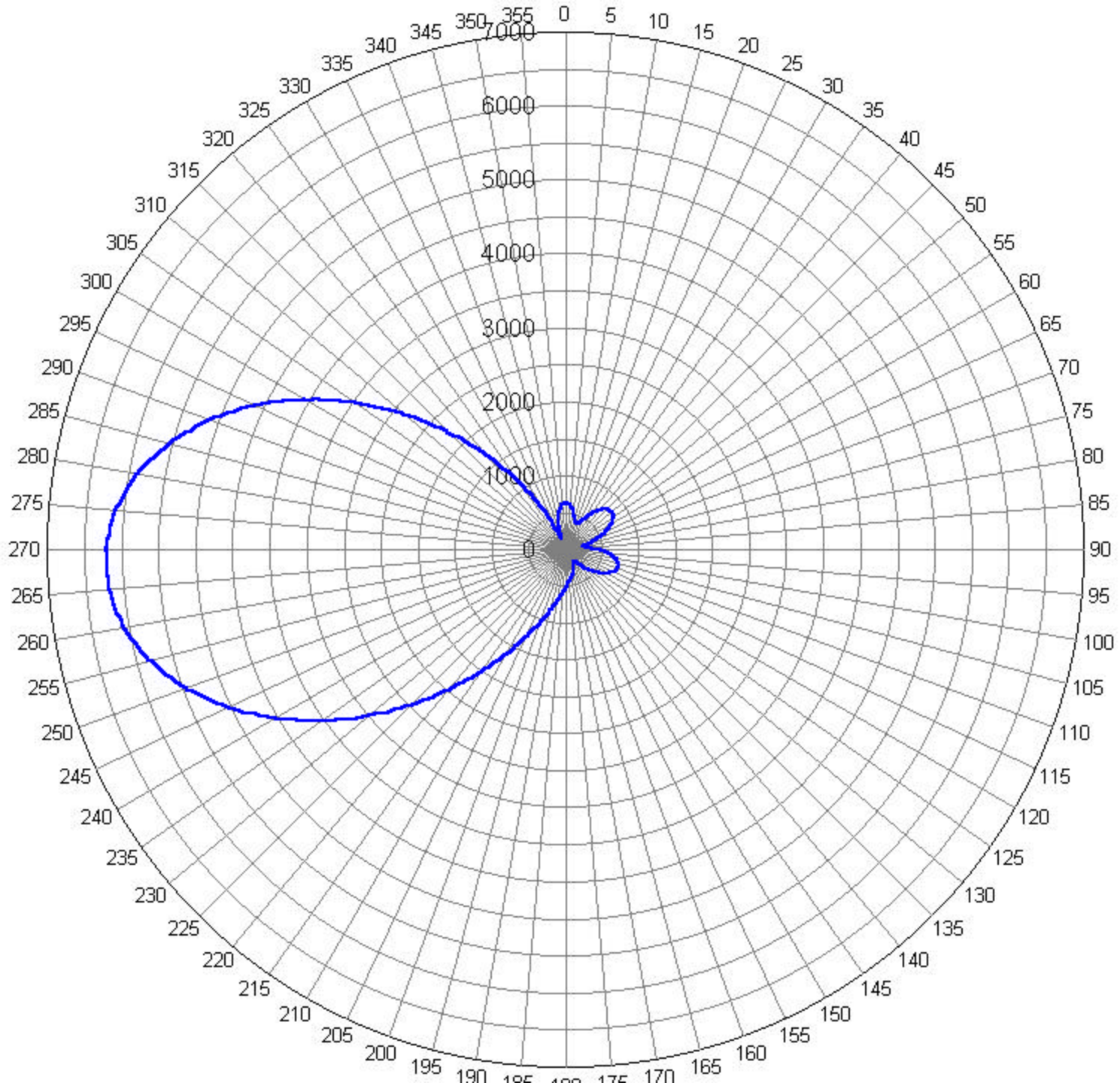
Technical Director

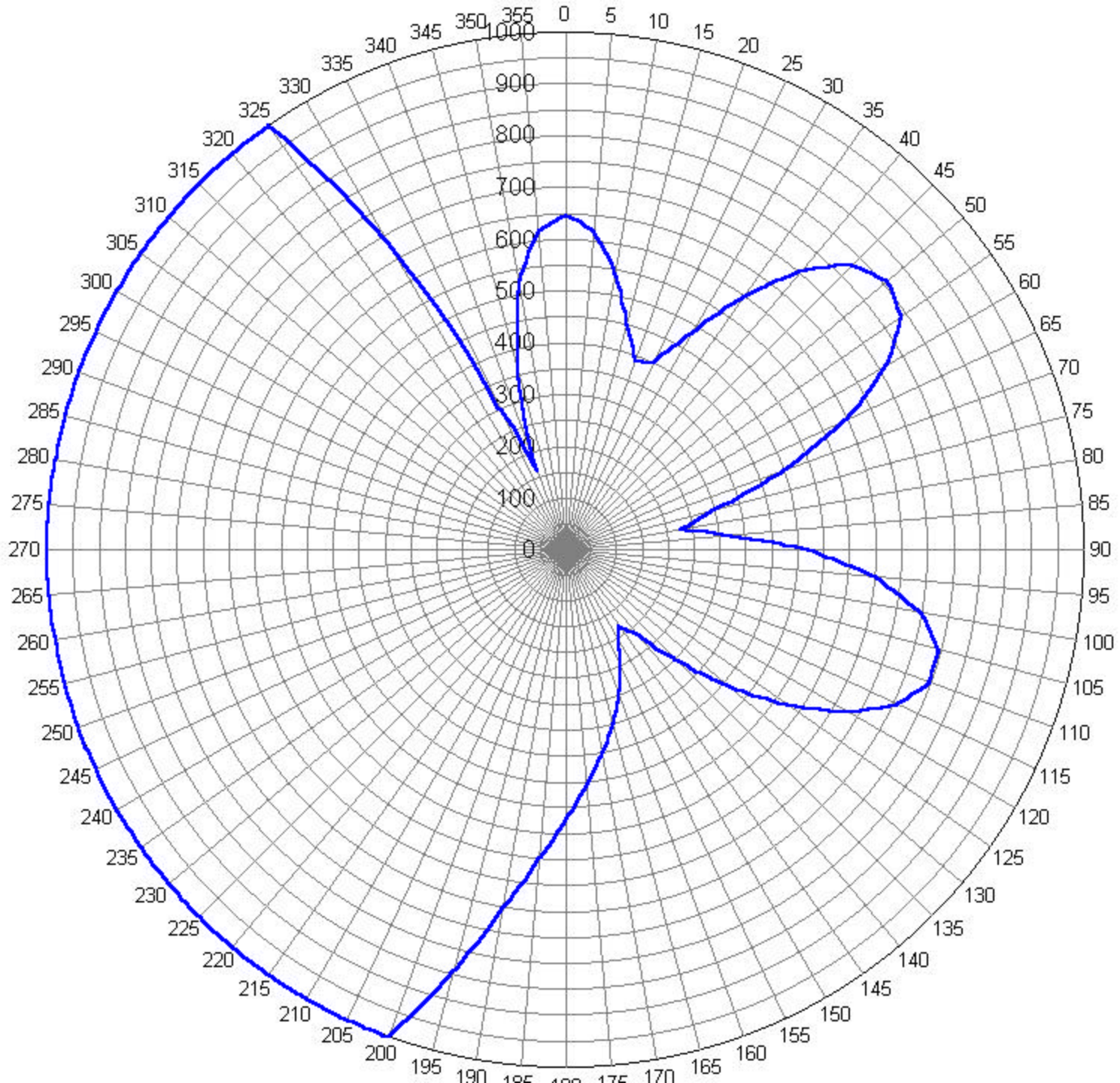
Registered Professional Engineer

Chief Operator

Technical Consultant

Other (specify)





RADIATION NULLS (VERTICAL ANGLE = 0 DEGREES)

AZIMUTH THEORETICAL STANDARD

22.1 381.825 409.291

79.4 221.273 246.507

144.9 178.293 204.529

338.8 143.424 171.651

RADIATION MAXIMAS (VERTICAL ANGLE 0 DEGREES)

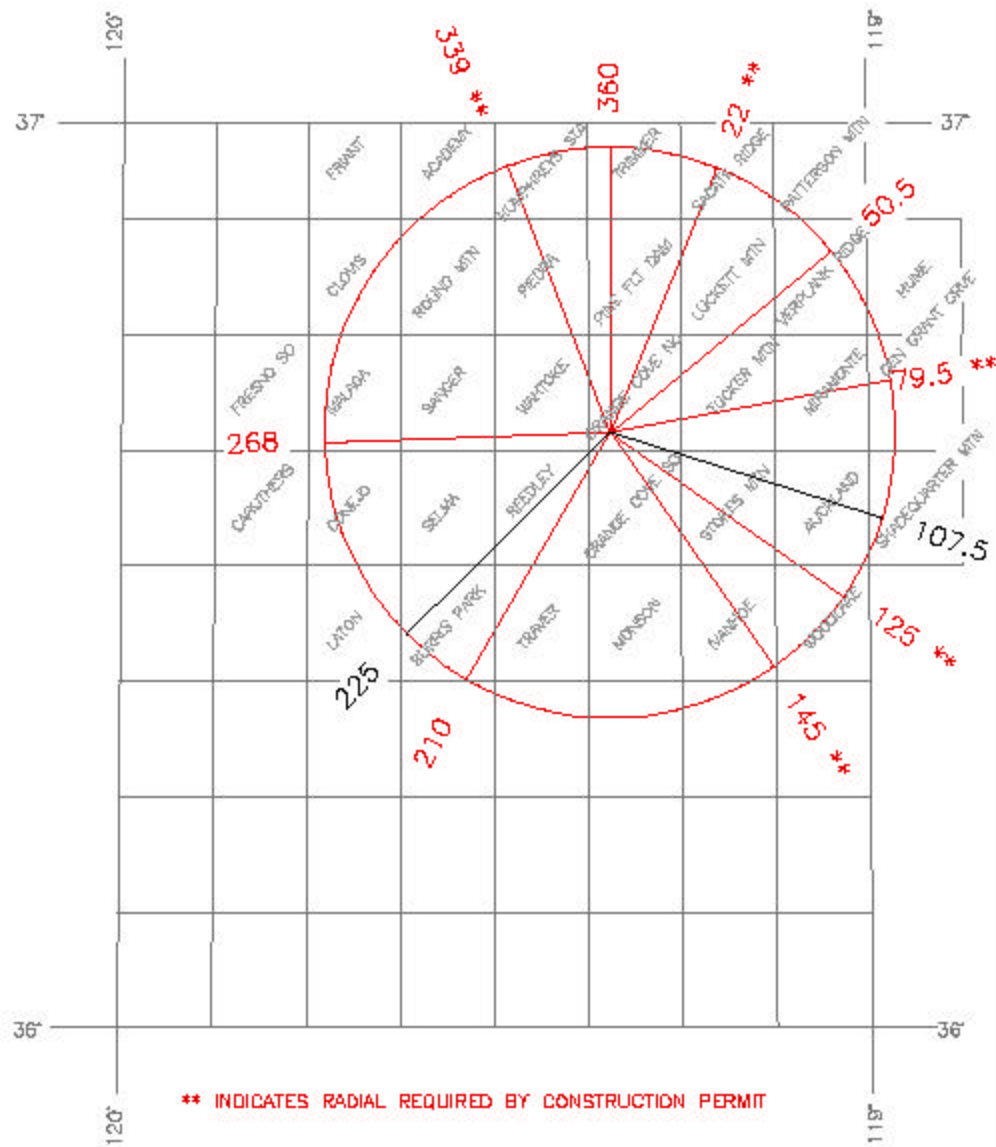
AZIMUTH THEORETICAL STANDARD

359.8 644.840 682.074

50.5 807.168 851.520

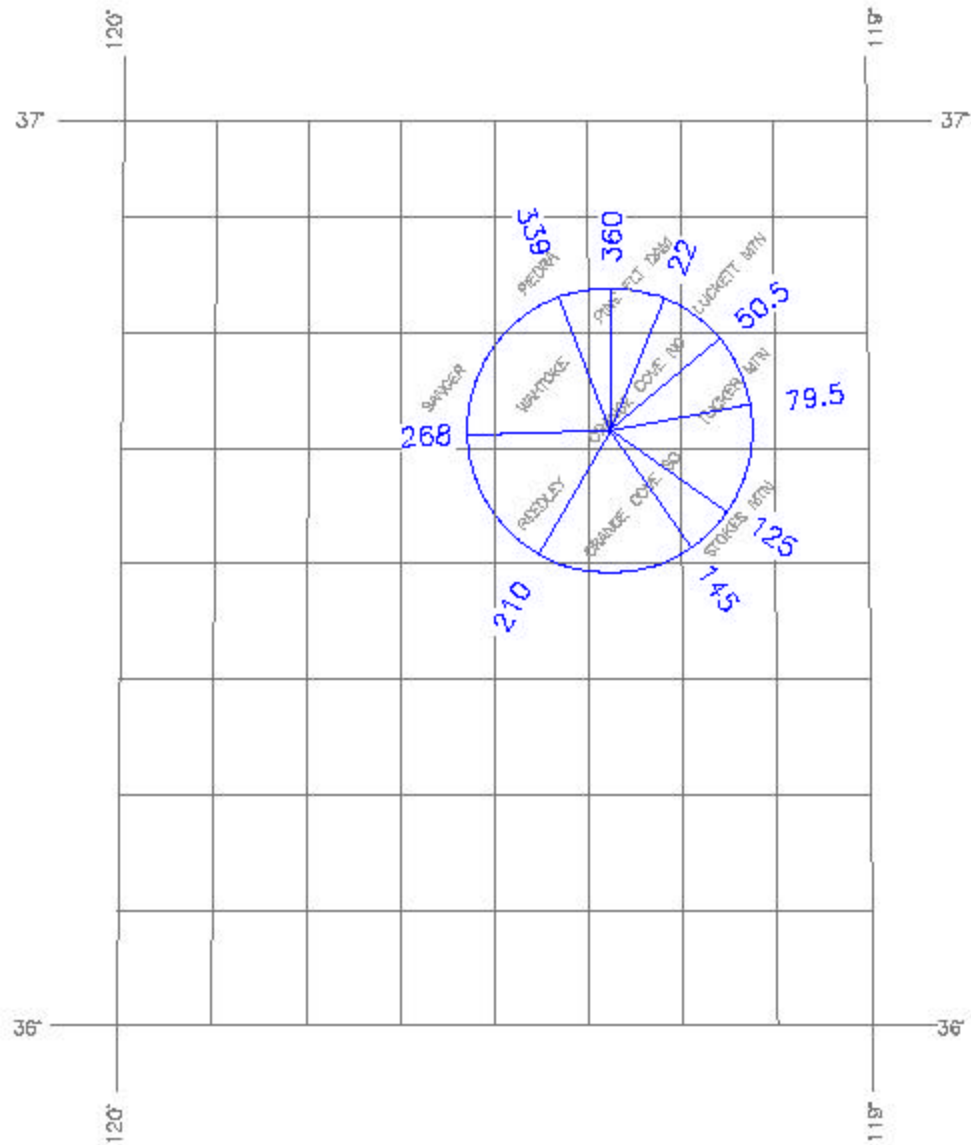
107.6 749.008 790.760

268.2 6192.592 6502.743



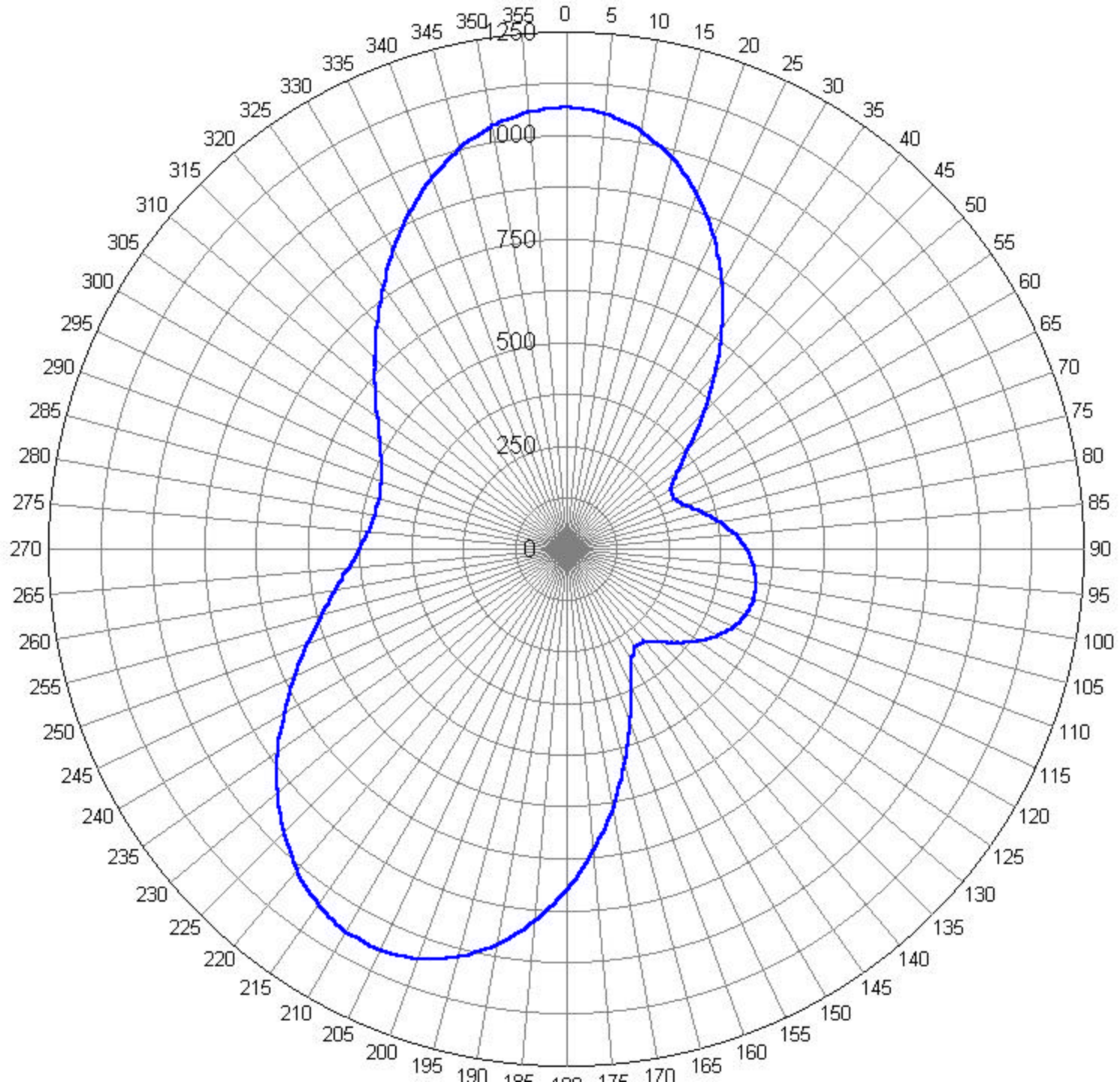
HATFIELD & DAWSON
CONSULTING ENGINEERS

EXAMPLE 2
11 RADIALS EXTENDING 30km FROM TRANSMITTER SITE
(SAME RADIALS AS EXAMPLE 1 with 2 ADDITIONAL RADIALS)



HATFIELD & DAWSON
CONSULTING ENGINEERS

EXAMPLE 1
9 RADIALS EXTENDING 15km FROM TRANSMITTER



RADIATION NULLS (VERTICAL ANGLE 0 DEGREES)

AZIMUTH THEORETICAL STANDARD

62.9 283.481 298.579

143.1 283.481 298.579

283.0 467.519 491.456

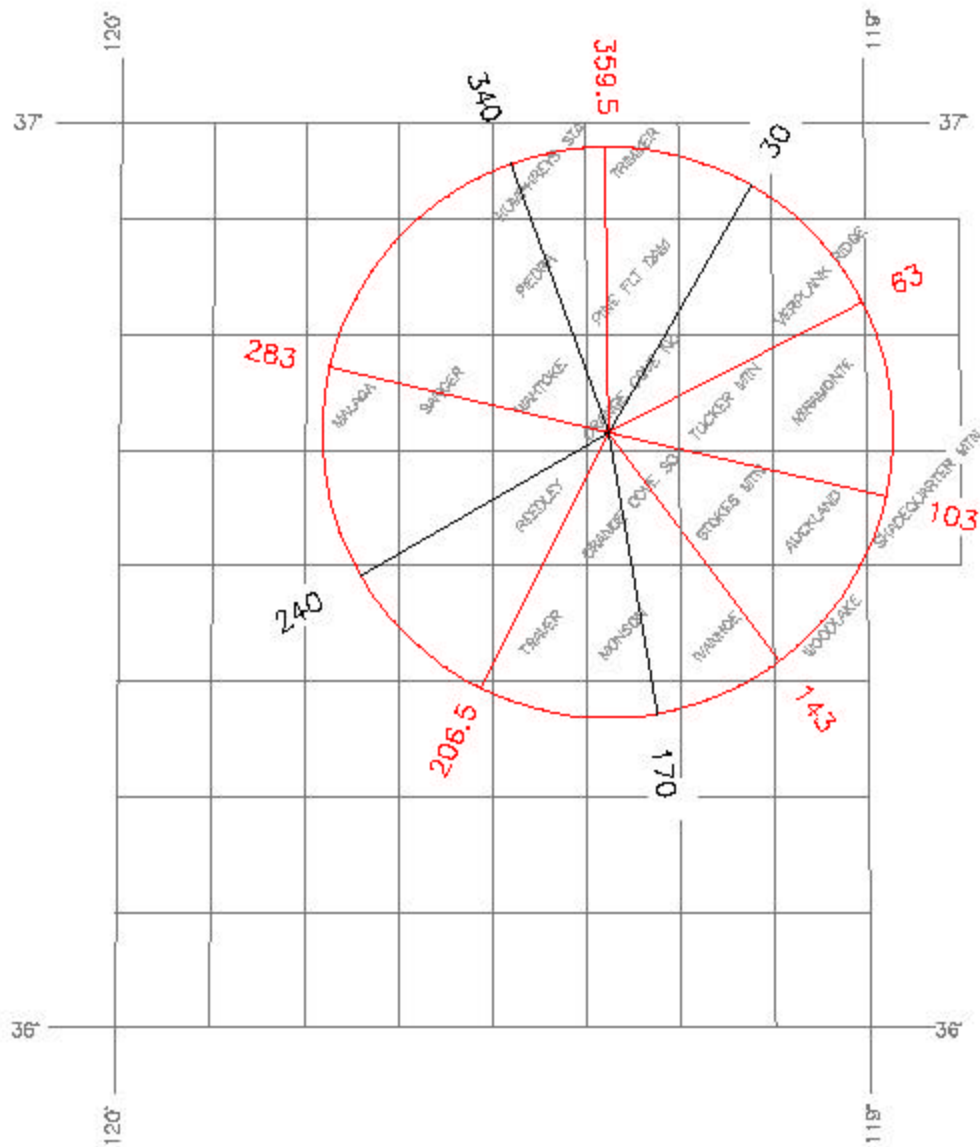
RADIATION MAXIMAS (VERTICAL ANGLE 0 DEGREES)

AZIMUTH THEORETICAL STANDARD

103.0 467.519 491.456

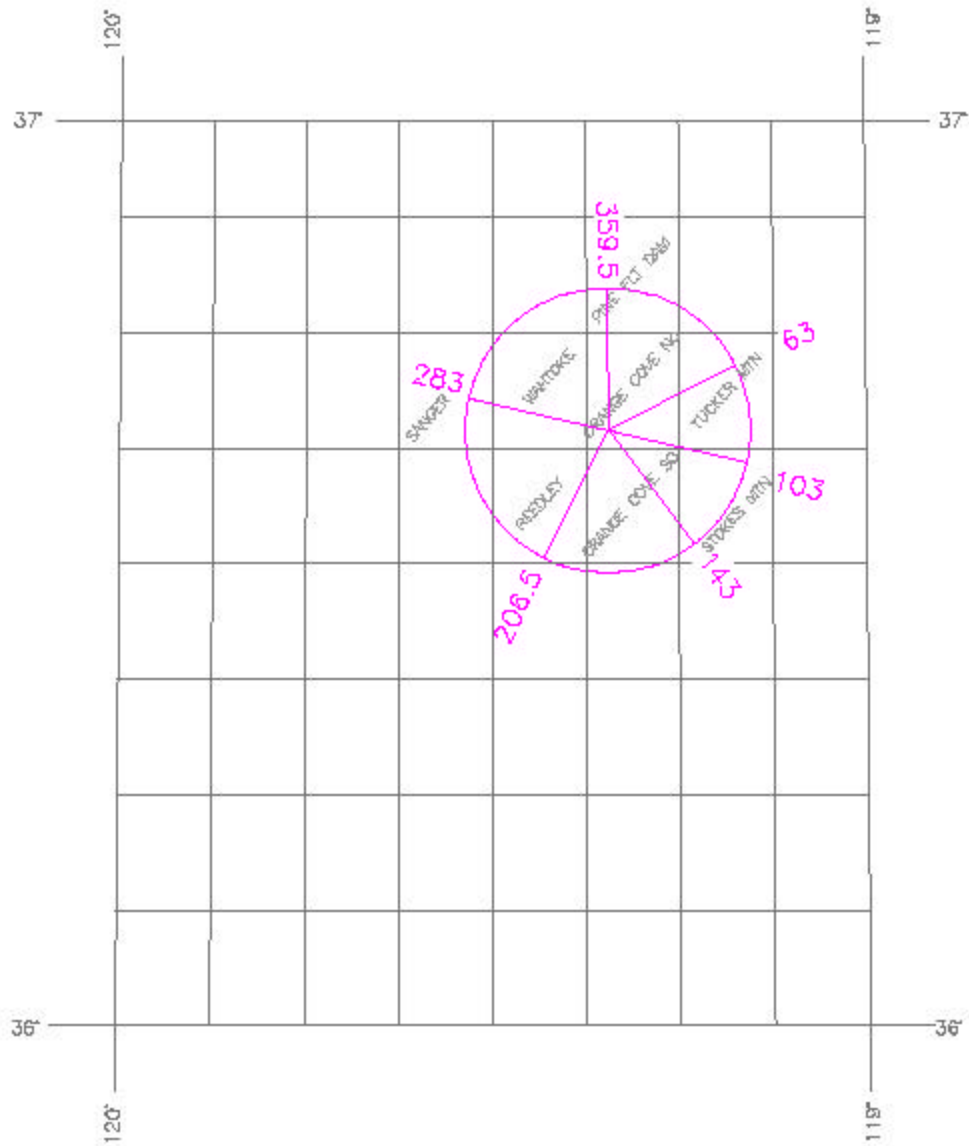
206.6 1066.424 1119.991

359.4 1066.424 1119.991



HATFIELD & DAWSON
CONSULTING ENGINEERS

EXAMPLE 4
10 RADIALS EXTENDING 30km FROM TRANSMITTER SITE
(SAME RADIALS AS EXAMPLE 3 with 4 ADDITIONAL RADIALS)



HATFIELD & DAWSON
CONSULTING ENGINEERS

EXAMPLE 3
8 RADIALS EXTENDING 15km FROM TRANSMITTER SITE

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New Requirements for Full Proof-of-Performance

- Minimum 6 Radials
- Maximum 12 Radials – May Assume Symmetry
- Minimum 15 Measurement Points Per Radial
- At Least 7 Measurement Points Within 3 km
- Measurements Unnecessary Beyond 15 km

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New Requirements for Partial Proof-of-Performance

- Minimum 4 Radials
- Radials at All Monitor Point Azimuths
- Less Than 4 Monitor Points – Measure Nearest to Monitored Radials
- 8 Measurement Point Per Radial

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Partial Proof-of-Performance Analysis Options

- DA/DA Comparison to Last Proof
- DA/ND With New Data – ND Field from Last Proof
- DA/ND With New Data – New ND Analysis
Additional Close-In Measurements (< 3 km) and Graphical Analysis Required

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New Uses For Partial Proofs-of-Performance

- May Select New Measurements Points Not From Full Proof
DA/ND Analysis Required
- May Establish New Monitor Points Not From Full Proof
DA/ND Analysis Required
- Monitor Point Limit Can Be Changed With Single-Radial Measurements
- Pattern Augmentation
Additional Close-In Measurements (< 3 km) and Graphical Analysis Required

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Other Matters

- No Critical Arrays
- No Base Current Meters
- Single Frequency Antenna Impedance Measurements
- Non-Zero Common Point Reactance
- Simplified Monitor Point Descriptions

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Materials Required to Be kept At Station

- Maps Showing Measurement Locations
- Schematic Showing Impedance Measurement Points
- Impedance Measurement Methodology Details
- Impedance Measurements Results

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Economic Considerations

- **Partial Proof-of-Performance**
 - About $\frac{1}{3}$ the present cost

- **Full Proof-of-Performance**
 - About $\frac{1}{2}$ the present cost

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Economic Considerations

- If computer performance verification is adopted...Full Proof-of-Performance cost could be as little as 10% of present cost

QUESTIONS ?