

Fundamentals of AM, FM, and TV Coverage and Interference Considerations.

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*Personally I think conservatives
and liberals should move towards
the middle of the road. Makes it
easier to run 'em over.*



Coverage Fundamentals

- **The importance of coverage and interference.**
- **Mechanics of broadcast coverage.**
- **Factoring in interference.**
- **International incidents.**
- **Examples.**



The Importance of Coverage and Interference

Importance of Coverage and Interference

- **We live and die by station coverage.**
- **The United States is somewhat unique.**
- **Criteria imposed for protection.**
- **Theory and practice vary.**
- **Rule compliance does not necessarily guarantee coverage.**
- **Rule compliance does not necessarily guarantee lack of interference.**

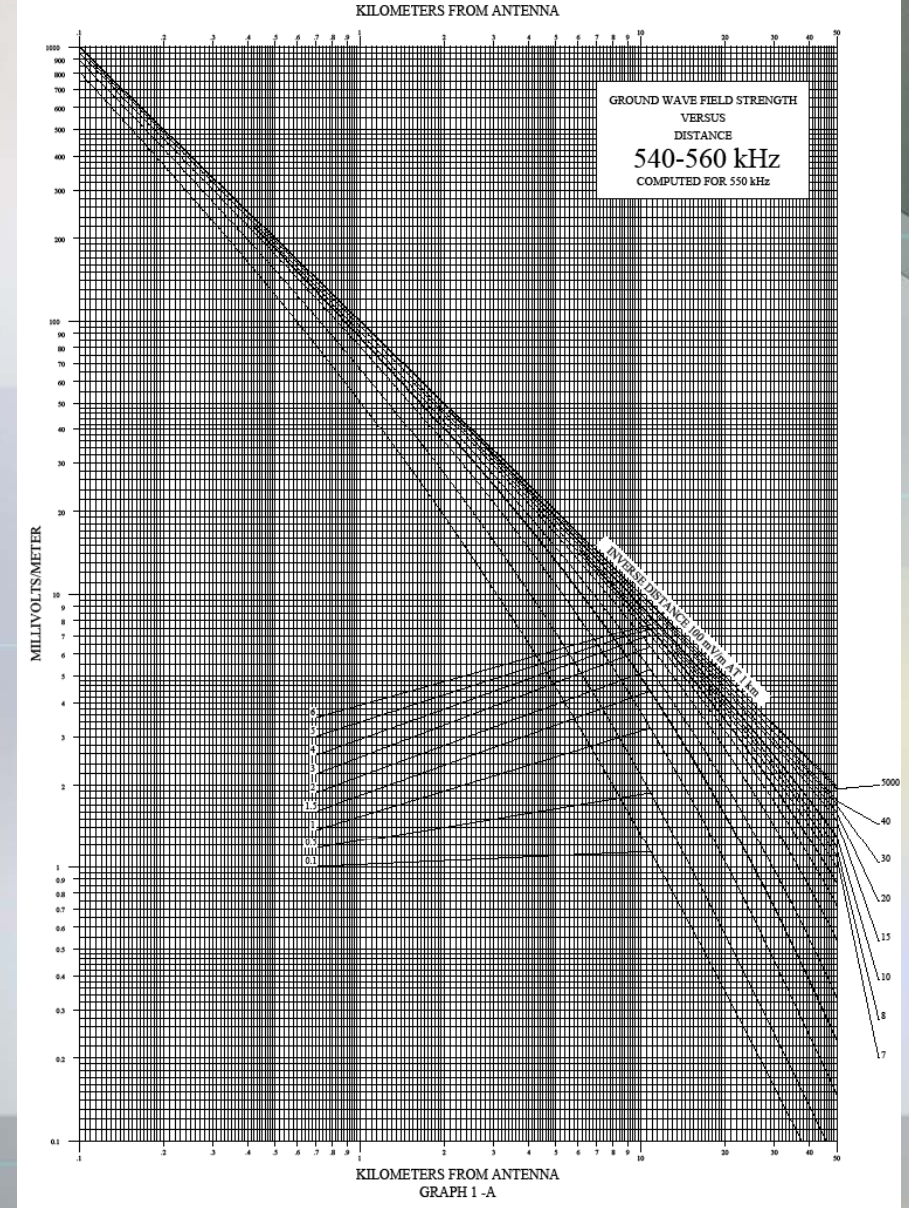
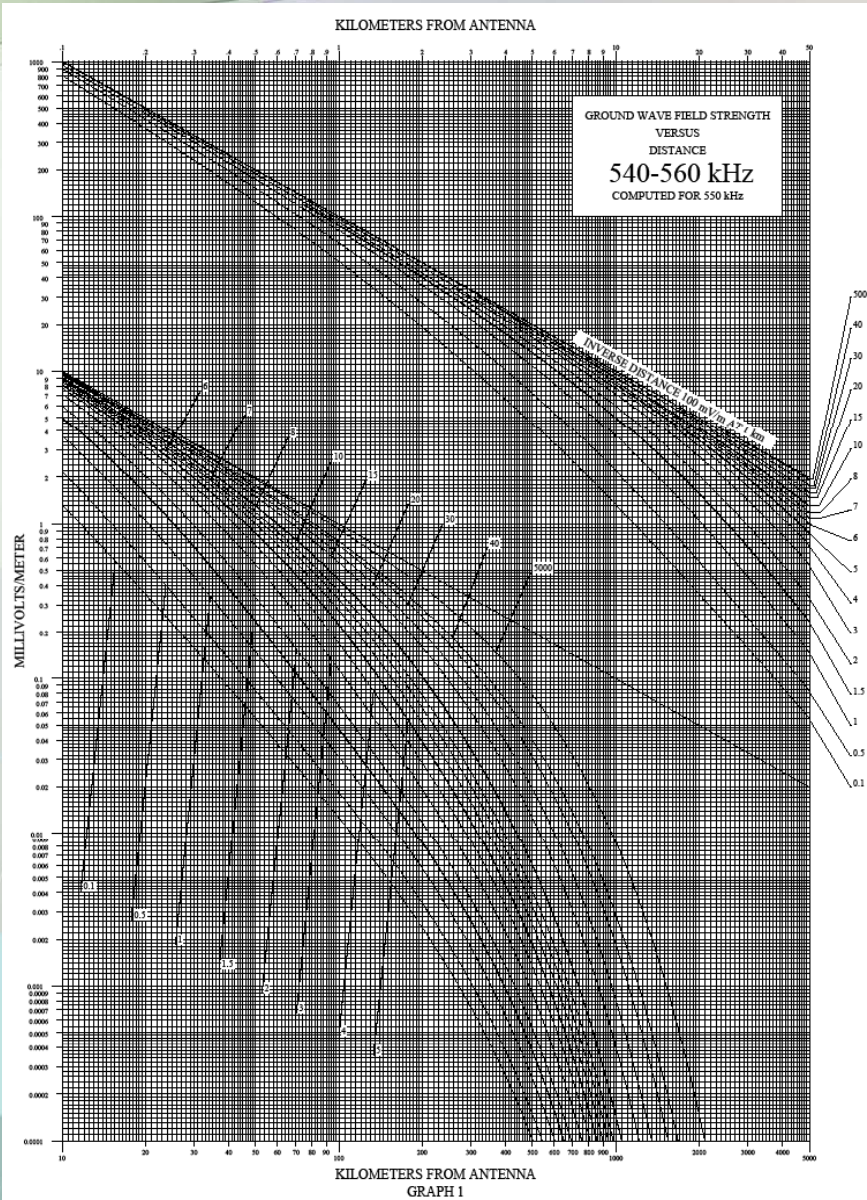


Mechanics of Broadcast Coverage

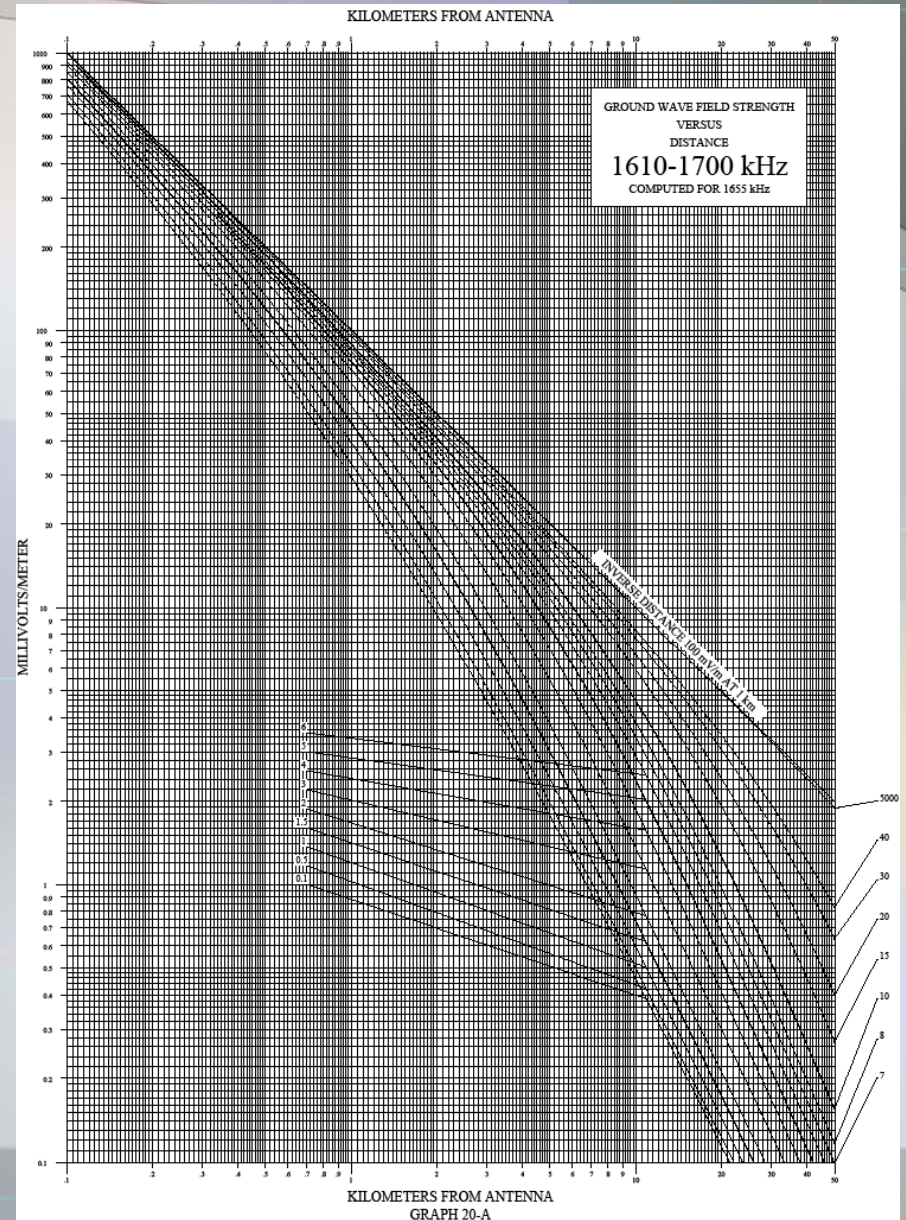
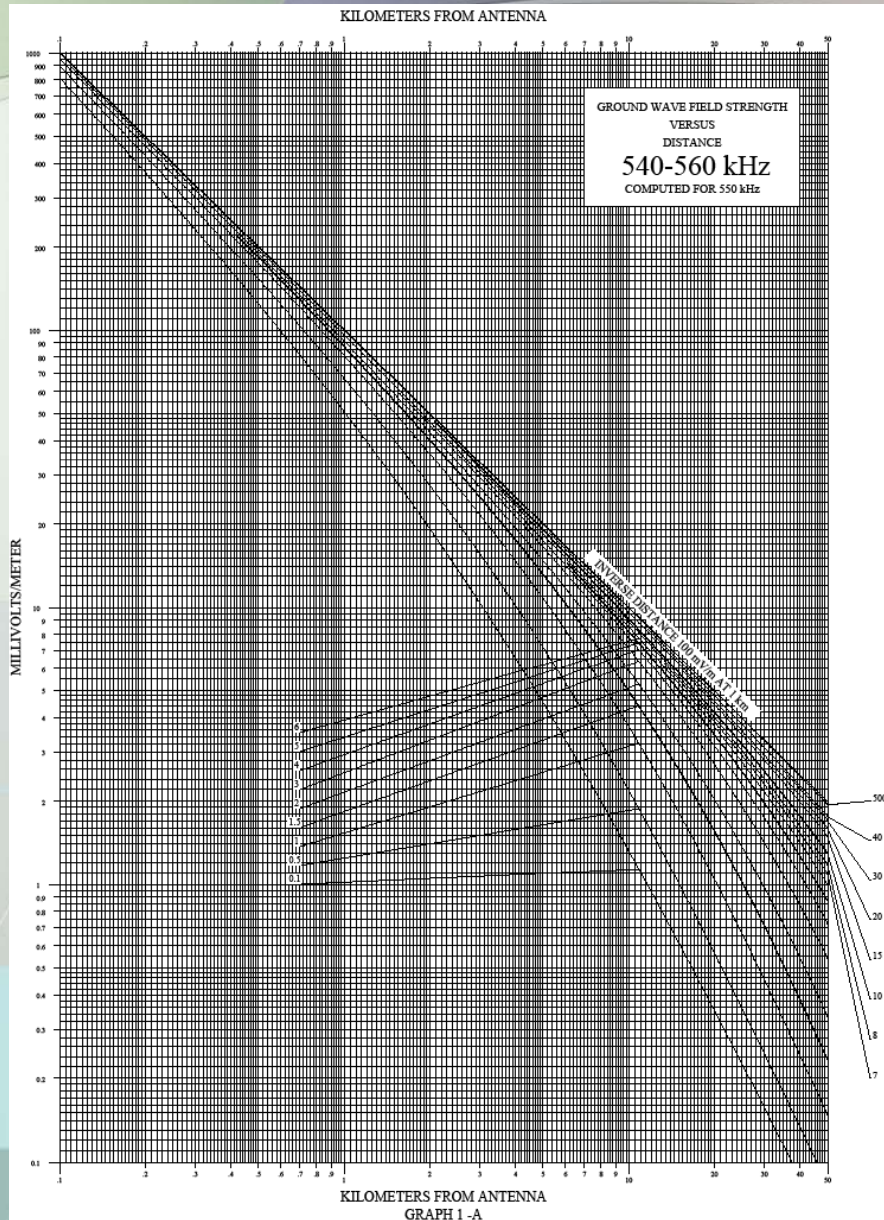
Mechanics of broadcast coverage

- Coverage based on defined models.
- All services use implementations of various propagation curves.
- For AM we look at groundwave and skywave curves.
- For FM & TV we look at different families of curves.
- Definition of coverage varies from *and* within services.

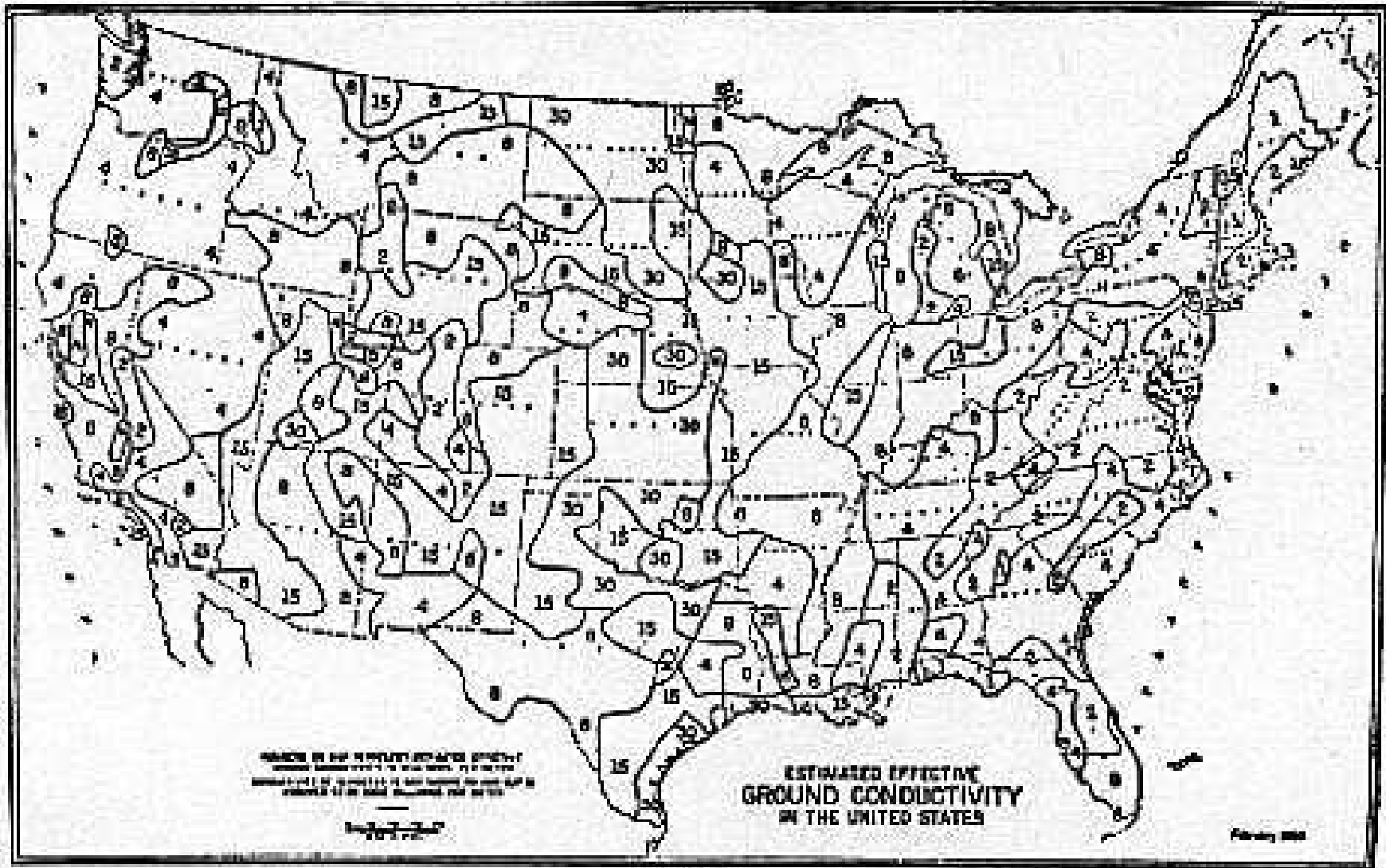
Mechanics of Broadcast Coverage



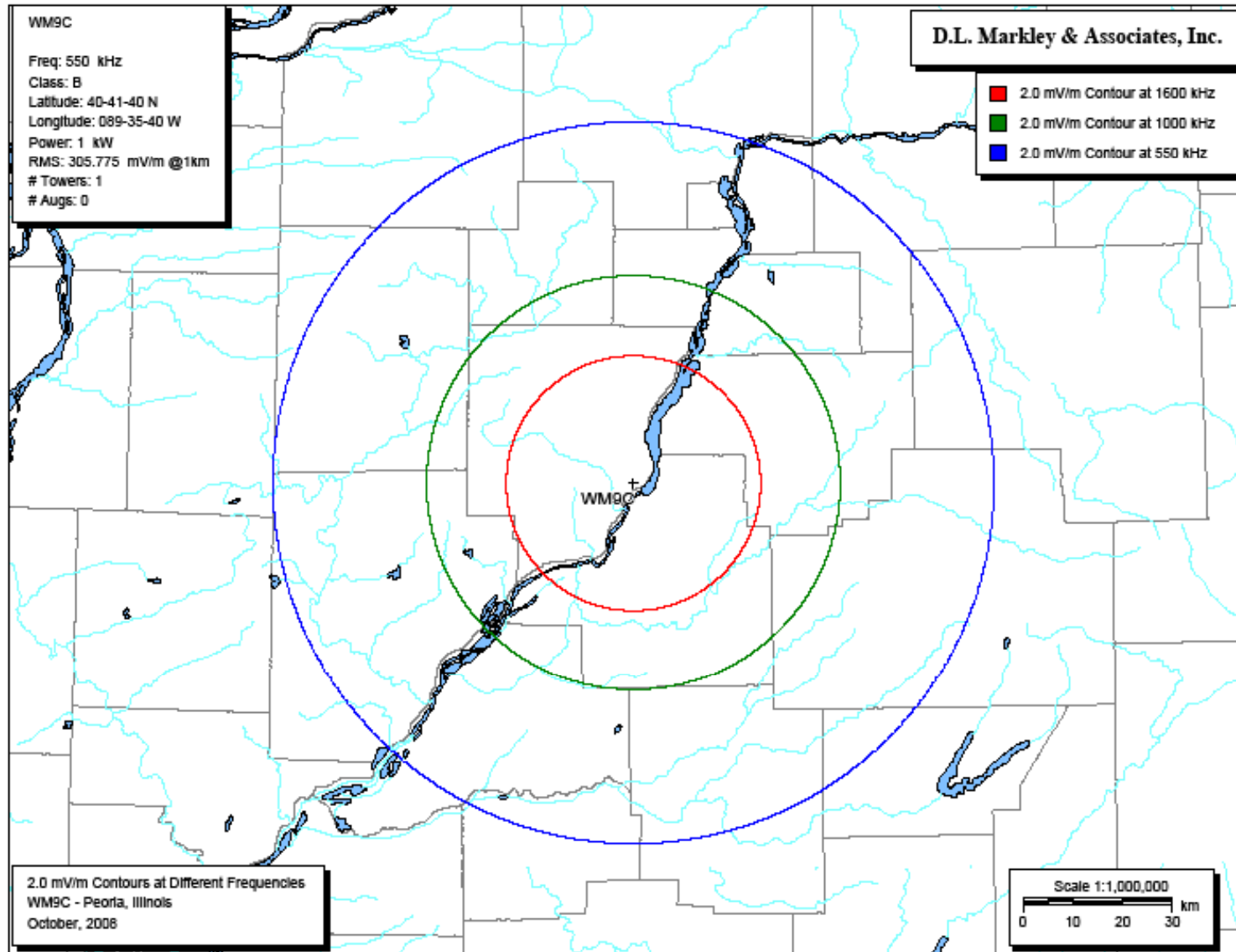
Mechanics of Broadcast Coverage



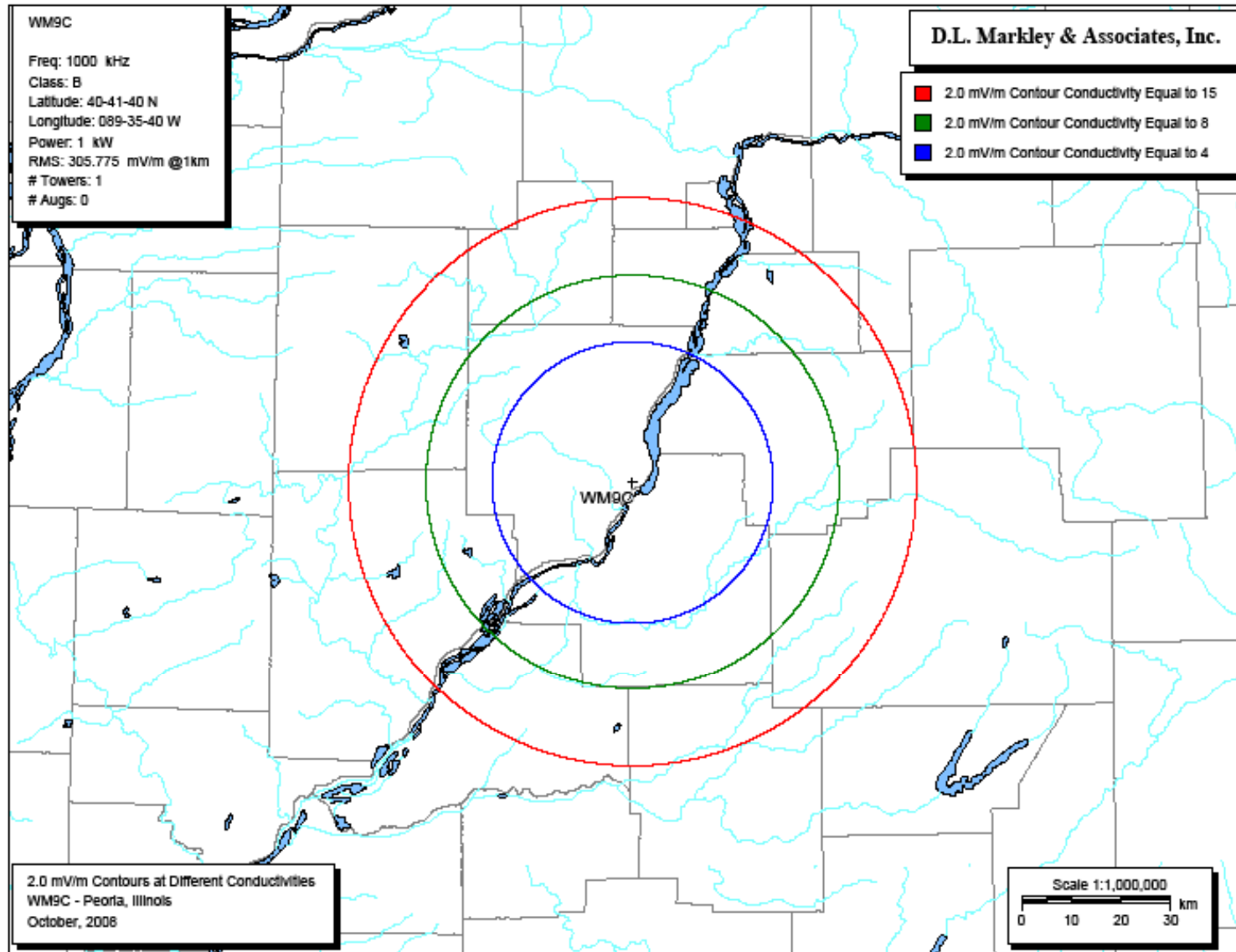
Mechanics of Broadcast Coverage



Mechanics of Broadcast Coverage



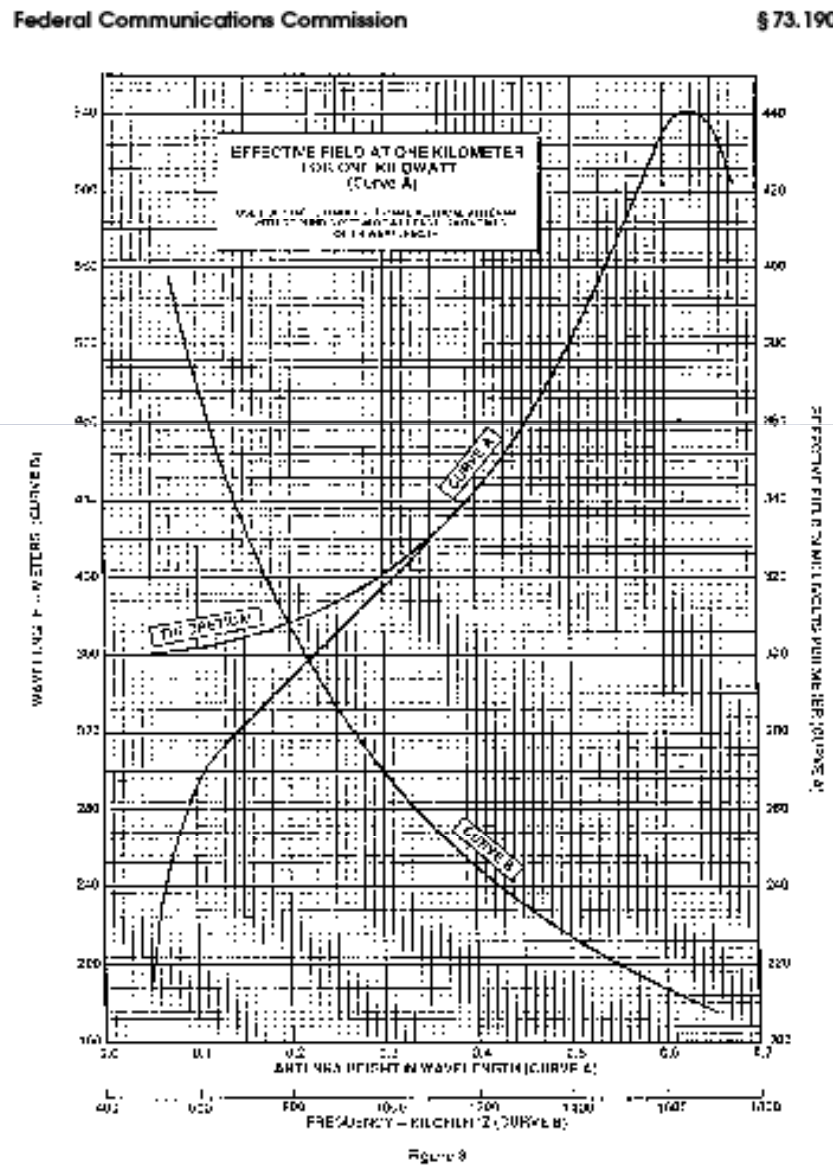
Mechanics of Broadcast Coverage



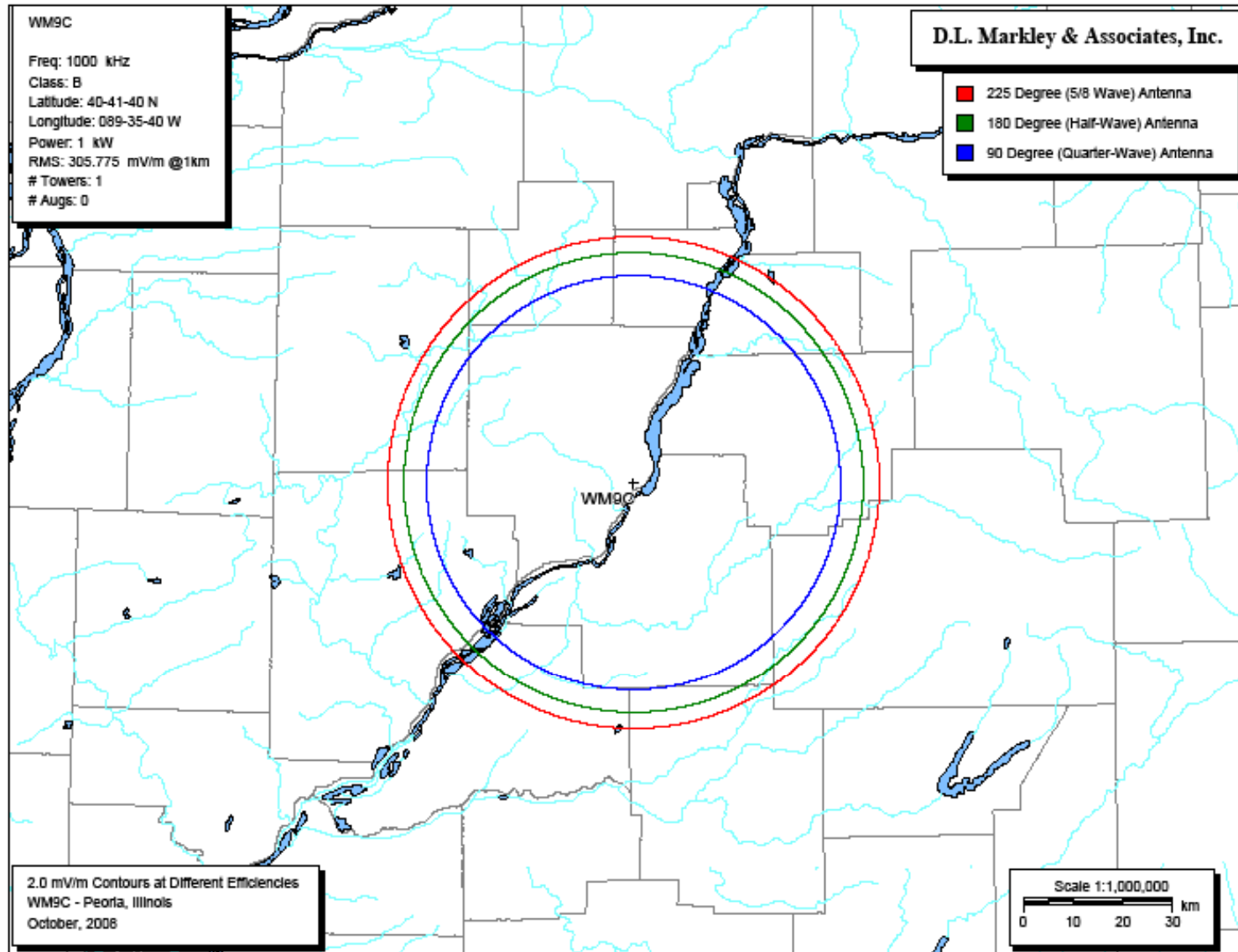
Mechanics of Broadcast Coverage

- **Function of Power.**
- **Function of Frequency.**
- **Function of Ground Conductivity.**
- **Function of Radiated Field.**

Mechanics of Broadcast Coverage



Mechanics of Broadcast Coverage



Mechanics of Broadcast Coverage

- Protected coverage based on class.
- Class B, C, and D protected to 0.5 mV/m groundwave daytime.
- Class A protected to 0.1 mV/m daytime.
- Class B & C typically protected to interference-free contour at night.
- Class A protected to 0.5 mV/m 50% Skywave contour.

Mechanics of Broadcast Coverage

- For FM and TV coverage is somewhat simpler.
- FCC method is predominant method for FM and NTSC facilities.
- A hybrid of FCC and Longley-Rice is used for DTV coverage predictions.
- Alternate methods such as Longley-Rice can be used for FM in special circumstances.

The FCC Contour Method

- Contour method uses families of curves.
- $F(50,50)$ curves used for coverage.
- $F(50,10)$ curves used for interference.
- Contour distance is determined by average terrain elevations in 3-16 km range from transmitter.
- This method falls apart very easily.

The FCC Contour Method

COR = 300 m AMSL		
km	Site #1	Site #2
3	100	0
4	100	0
5	100	0
6	100	0
7	100	0
8	100	0
9	100	1400
10	100	0
11	100	0
12	100	0
13	100	0
14	100	0
15	100	0
16	100	0
Average:	100	100

- The FCC Method predicts the same coverage for these two scenarios.
- Obviously in case #2 the signal is severely impeded.
- This is an extreme example.

The FCC Contour Method

- The FCC method works better on moderate terrain.
- Mountainous terrain causes significant issues.
- Similarly excessively smooth terrain causes issues.
- The Commission has recognized this and allows Longley-Rice in certain cases.

Longley-Rice Model

- Longley-Rice is terrain dependent.
- Terrain is considered as well as signal paths along entire radial.
- The result is a much better approximation of coverage.
- Availability of cheaper computing power has made Longley-Rice much more prevalent.

Longley-Rice Model

- Applicability of Longley-Rice in cases of FM is typically limited to city of license coverage or main studio coverage.
- Use of Longley-Rice is not used for FM interference situations.
- Longley-Rice usable for translator, LPTV, Class A, and DTV interference.
- Longley-Rice is intimately involved with DTV coverage predictions.

Coverage of FM Stations

- Protected coverage area of FM stations defined by contour determined by FCC method using F(50,50) curves.
- Class A, C, C0, C1, C2, and C3 are all protected to 60 dBu or 1.0 mV/m.
- Class B1 is protected to 57 dBu or 0.7 mV/m.
- Class B is protected to 54 dBu or 0.5 mV/m.

Coverage of FM Stations

- **Interference by FCC contour method not permitted within these contours.**
- **This does not mean that interference will not occur.**
- **The Commission leaves themselves an out in Section 73.209 of the Rules.**

Coverage of NTSC Stations

- Protected coverage here is defined by Grade B service contour.
- VHF Low is 47 dBu F(50,50).
- VHF High is 56 dBu F(50,50).
- UHF is 64 dBu F(50,50).
- This is the last time I get to use these numbers here.

Coverage of DTV Stations

- Protected coverage of DTV uses both FCC method and Longley-Rice.
- Protected coverage is defined as the service area.
- This is the area within the noise limited contour receiving a Longley-Rice predicted interference-free signal equal to or in excess of the noise limited contour value.

Coverage of DTV Stations

- **Expect interference within the noise limited contour.**
- **Expect areas of signal in excess of the noise limited value outside the contour.**
- **This is the area to which you are protected, but is not necessarily equal to the practical limit of coverage.**
- **Actual coverage may be greater than or less than contour distance.**

Coverage of DTV Stations

- Compensation for antenna is used.
- VHF Low noise limited value is 28 dBu F(50,90).
- VHF High noise limited value is 36 dBu F(50,90).
- UHF noise limited value is 41 dBu F(50,90).
- Although F(50,90) is used for coverage, F(50,10) is still used for interference.

The background features a complex composition of overlapping semi-transparent shapes in shades of green, blue, and purple. A faint grid of thin lines is visible across the entire image. The text 'Factoring in Interference' is centered in a bold, yellow font.

Factoring in Interference

Factoring in Interference

- For FM stations primary method of avoiding interference is through geographic spacings.
- Spacing tables are based on contour distances assuming uniform terrain.
- Irregular terrain will obviously skew contour distances.
- It is possible to meet spacings and yet fail contour overlap requirements.

Factoring In Interference

- If spacings are not met, contour protection is an option.
- Stations employing contour protection forfeit their rights to “full” interference protection.
- This can sometimes be beneficial if it means serving a significantly larger population.
- Contour protection still has to meet minimum spacing requirements.

Factoring In Interference

- **The absolute minimums have their root in the maximum front to back ratio permitted on directional antennas.**
- **Directional antennas are of course permissible for interference protection in AM, FM, and TV.**
- **Directional antennas can also be used for certain coverage goals in all three services.**

Factoring in Interference

- **Contour protection can also be achieved through a reduction in ERP.**
- **Similarly a reduction in antenna height can be used for contour protection.**
- **Both of these methods can result in loss of coverage.**



International Incidents

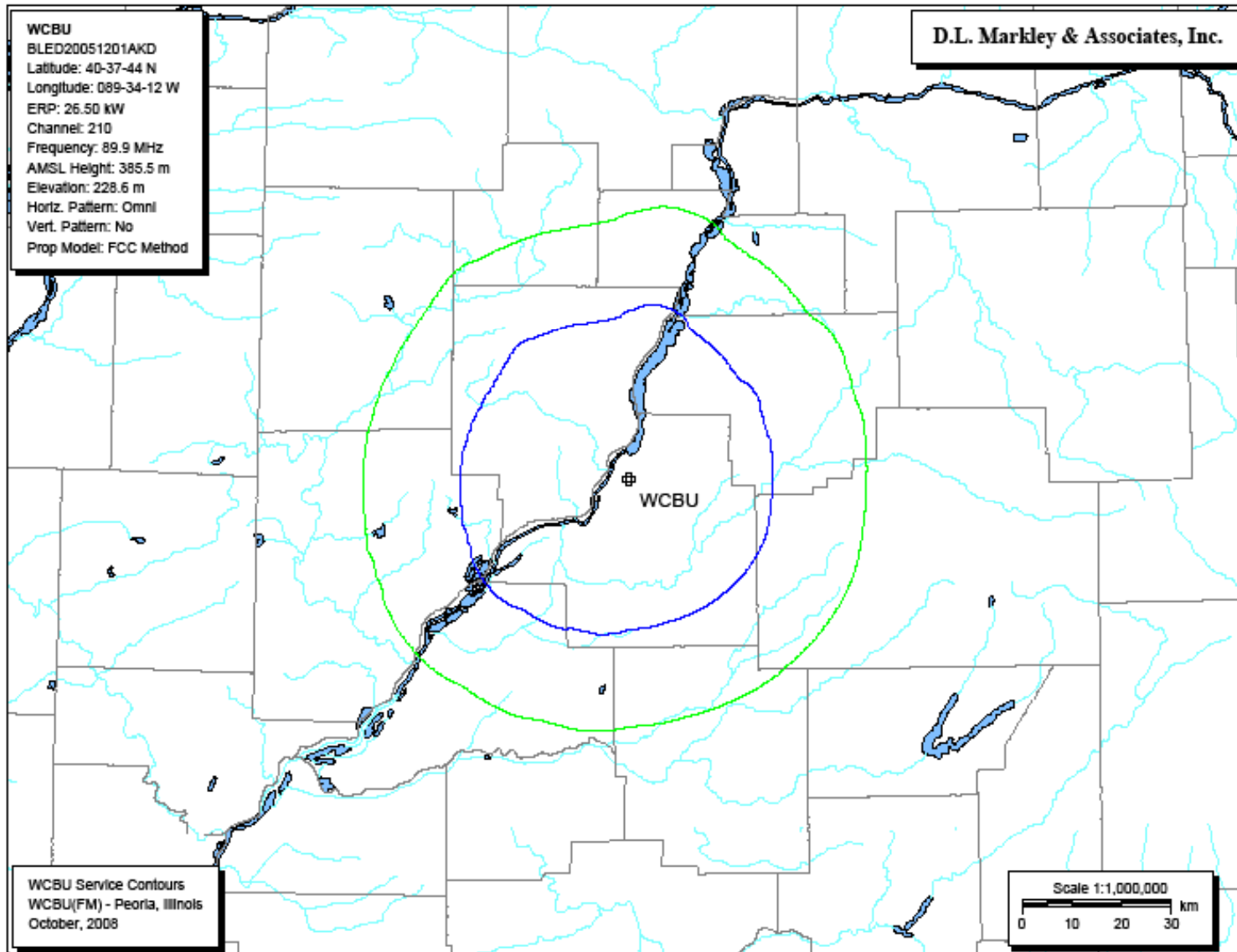
International Incidents

- North America is fortunate to have cooperation in international matters.
- Agreements exist with countries bordering the United States to address mutual cooperation.
- Typically interference protection is not afforded to a station in a different country.
- Time constraints will have to limit this discussion.

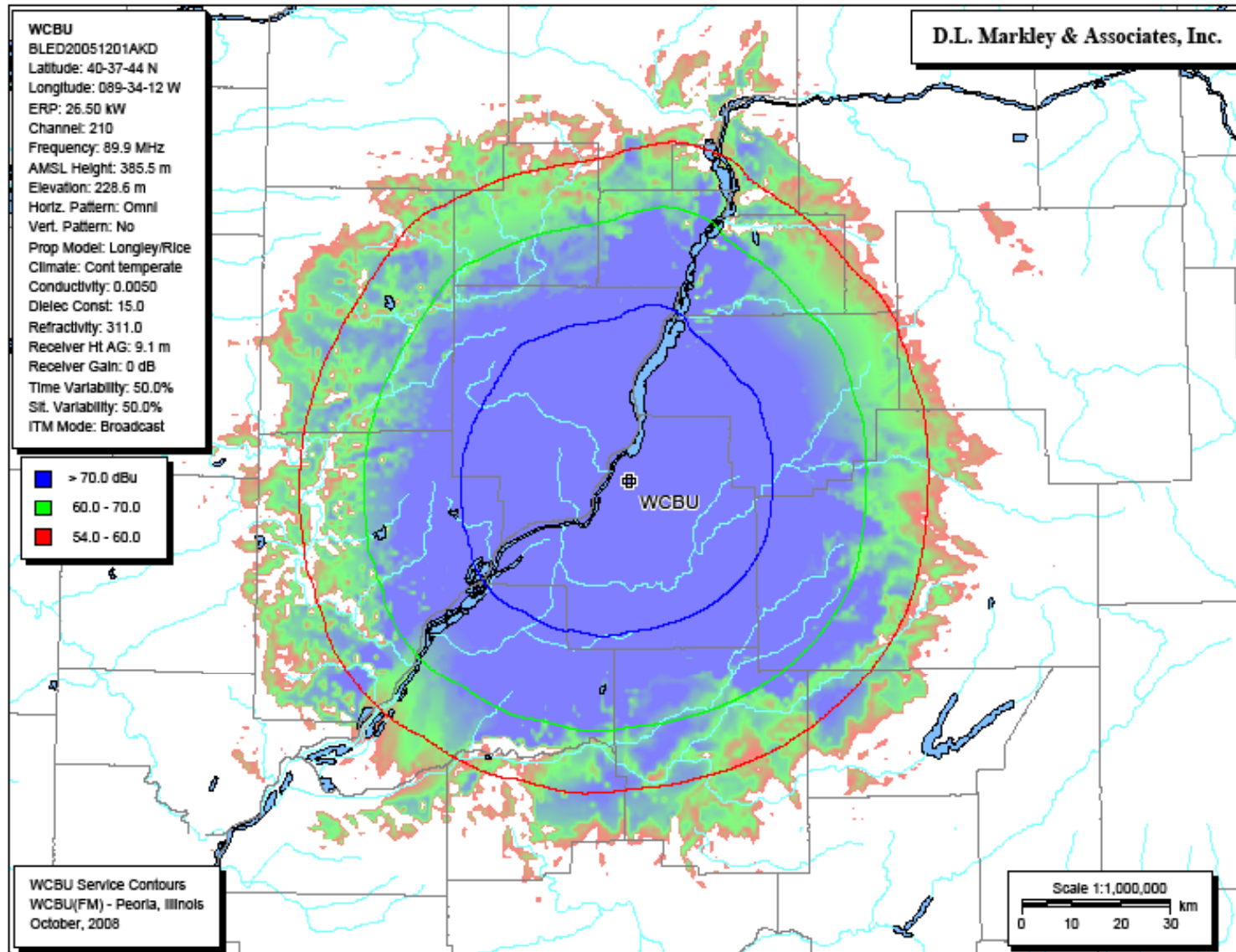
Examples

The background features a complex composition of overlapping semi-transparent shapes. A large, light blue/purple shape dominates the center, with a white-to-yellow gradient. To its left, a green shape is partially visible. Below the main shape, there's a teal and a dark blue area. On the right, a dark grey shape is present. A grid of thin, light blue lines is overlaid on the entire scene, creating a technical or architectural feel.

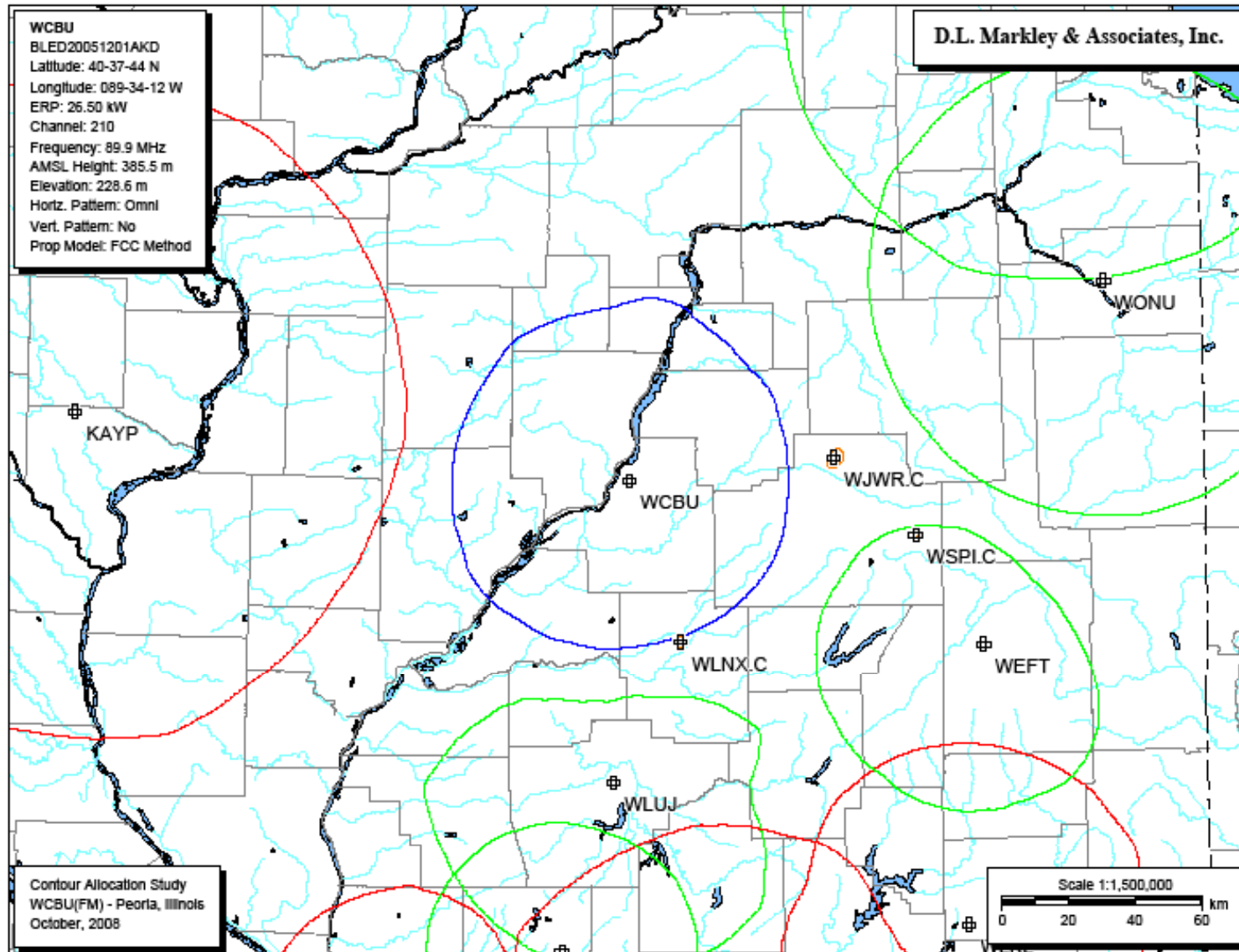
Examples – FM Station Service Contours



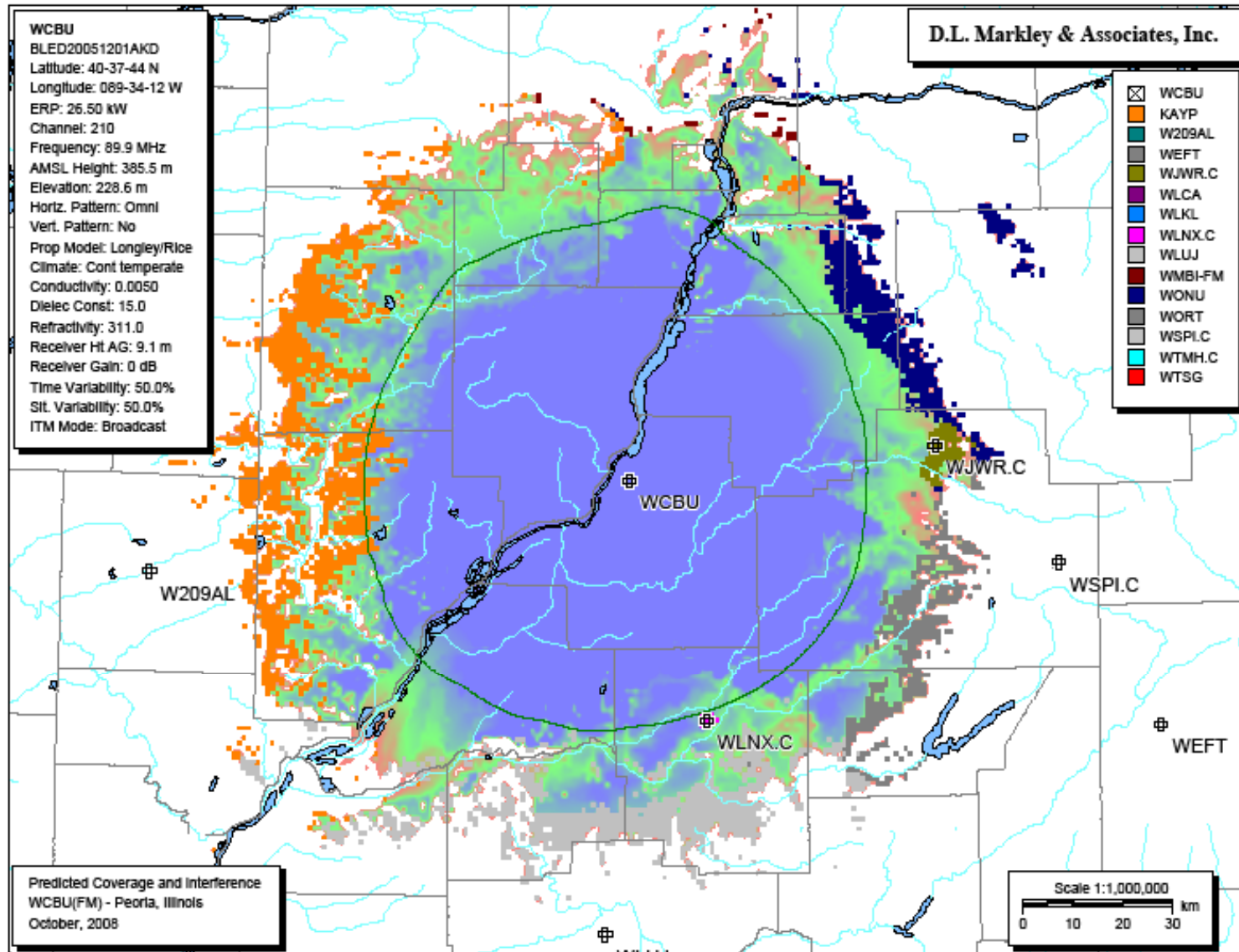
Examples – FM Contours / L-R Coverage



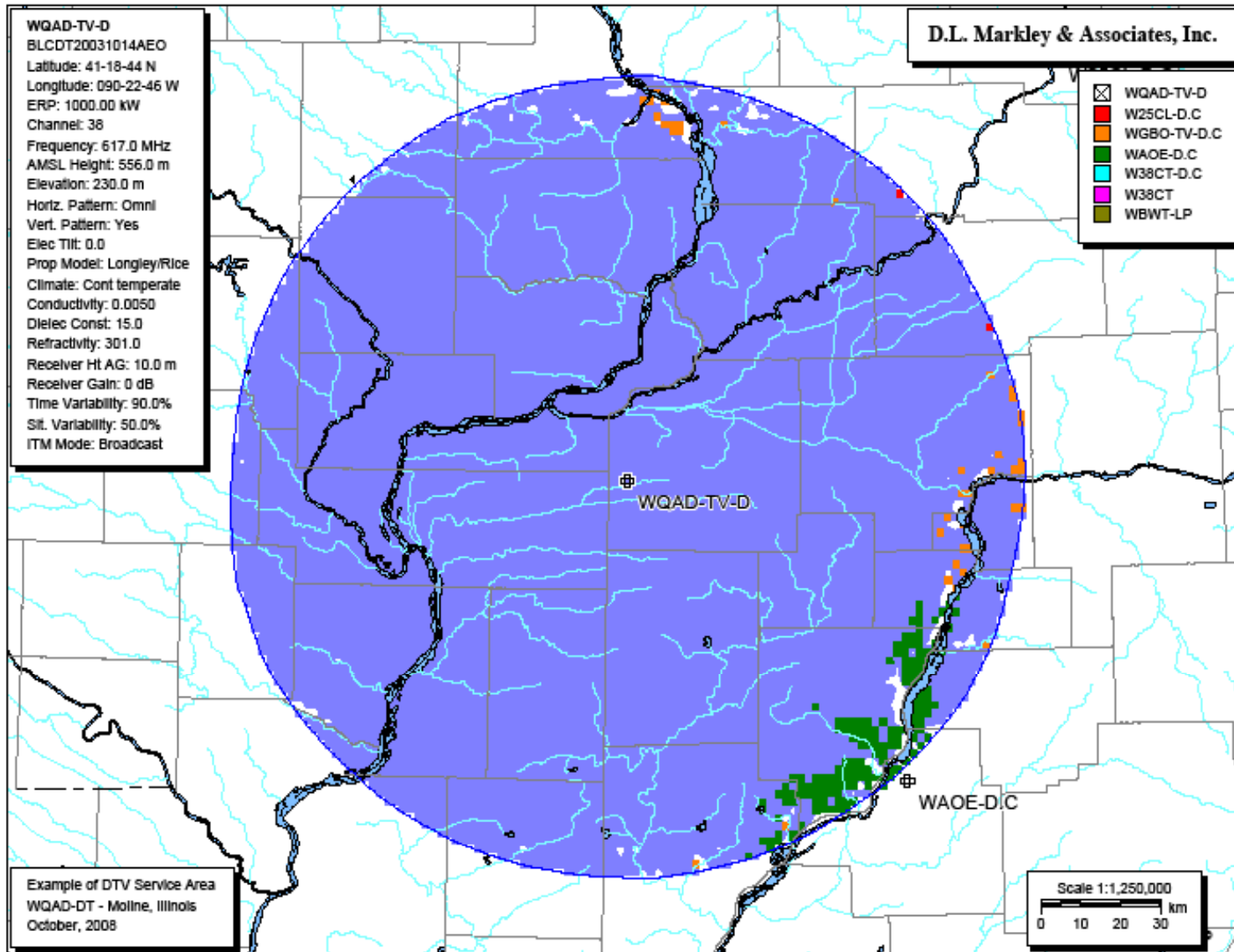
Examples – NCE FM Allocation Study



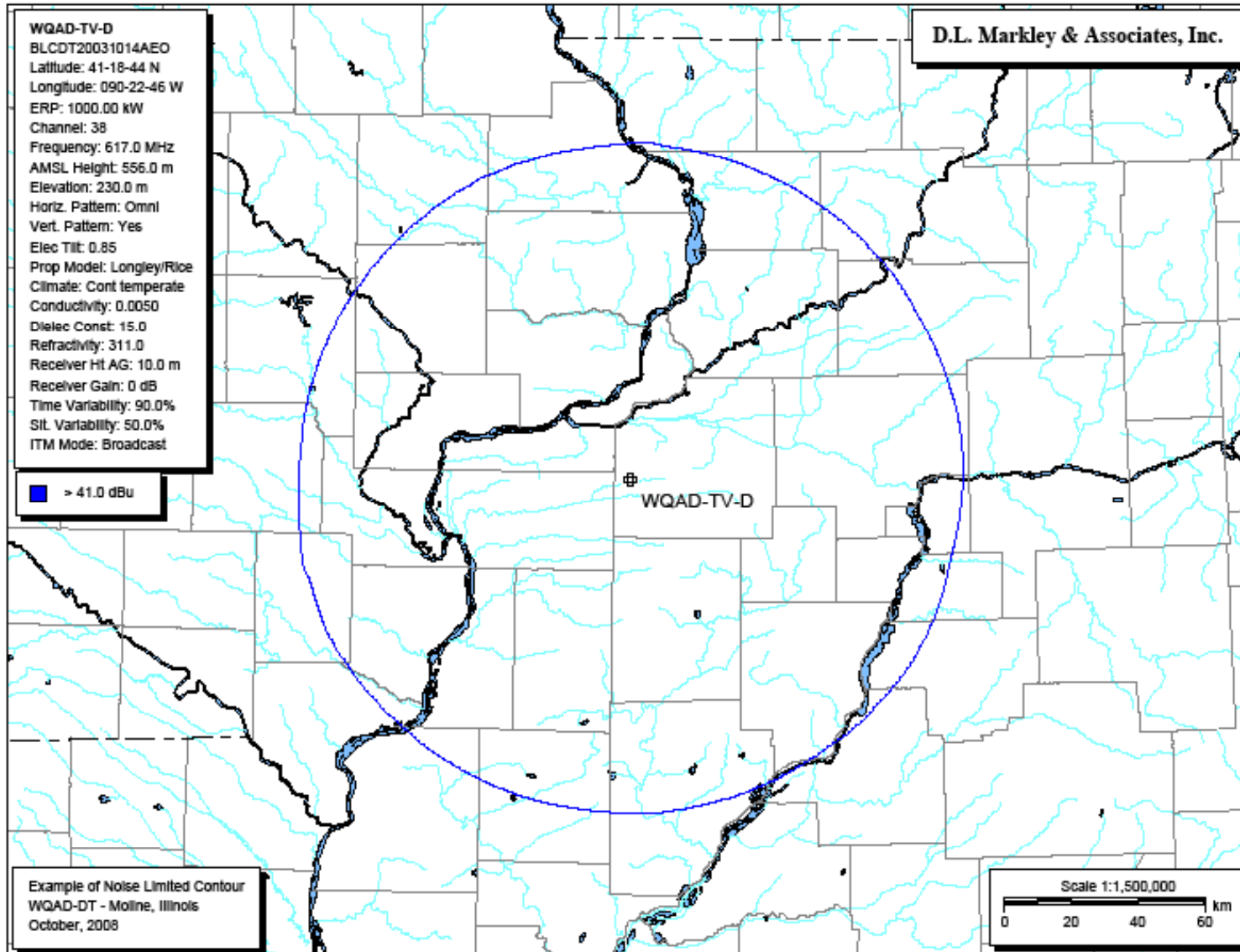
Examples – FM Coverage / Interference



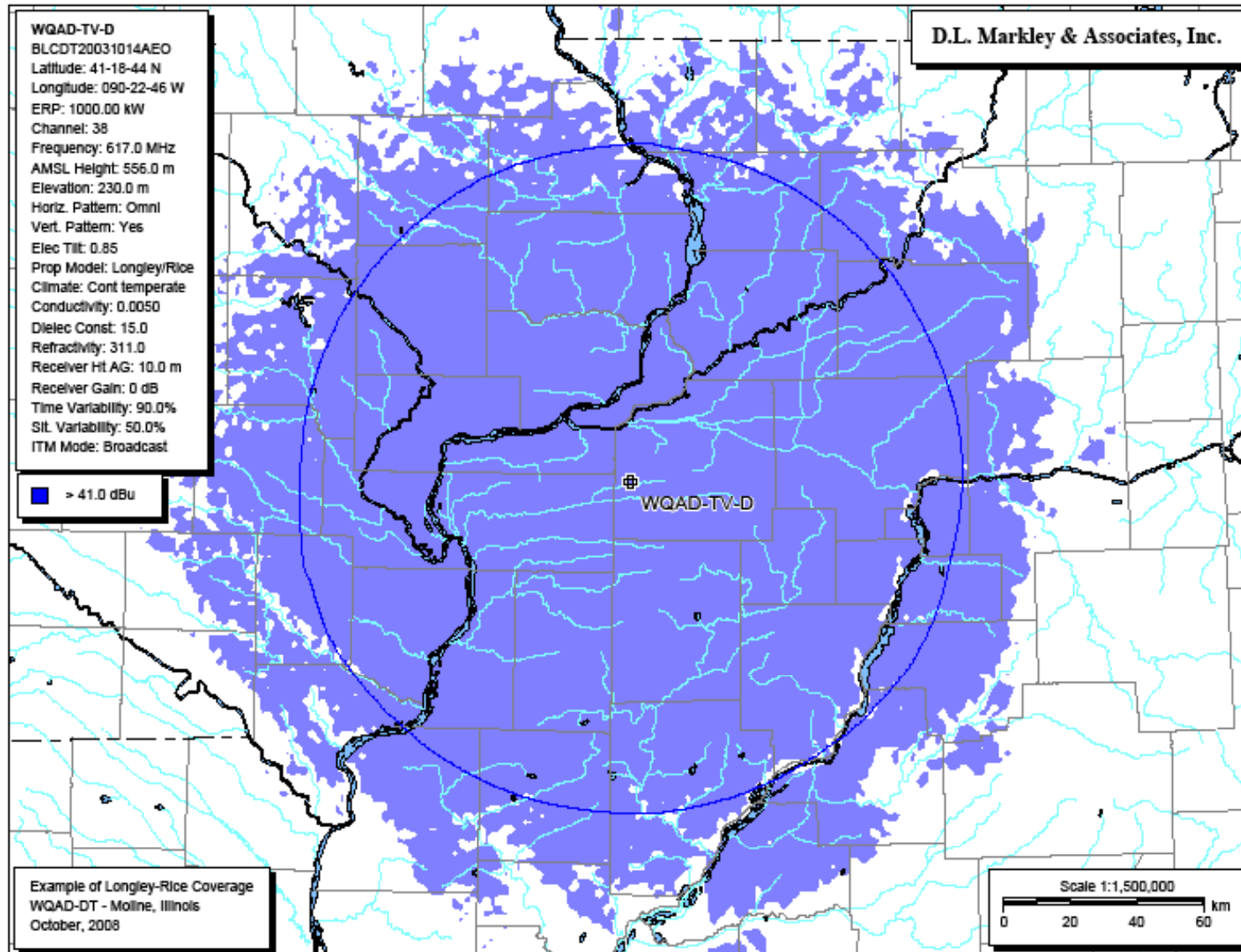
Examples – DTV Service Area



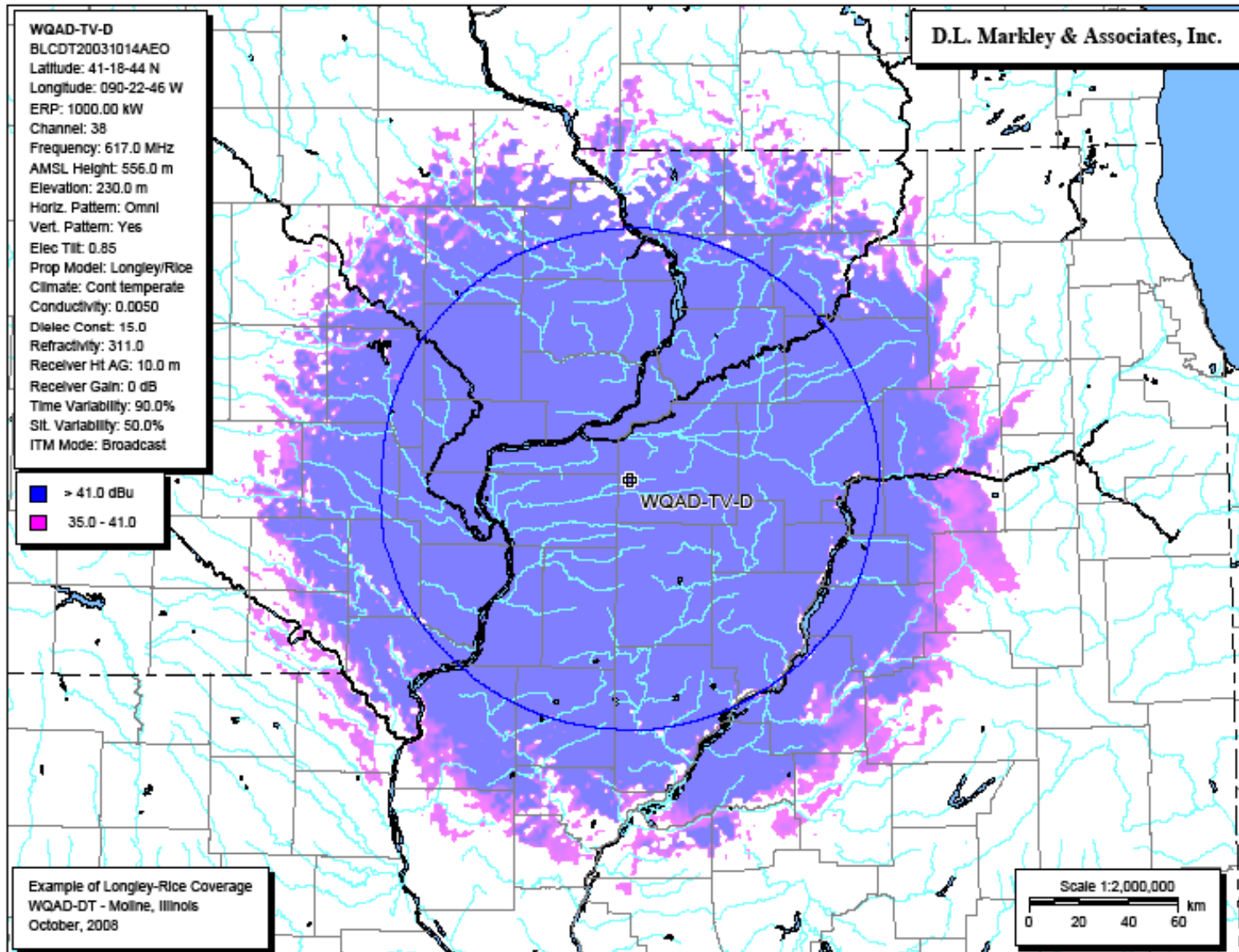
Examples – DTV Noise Limited Contour



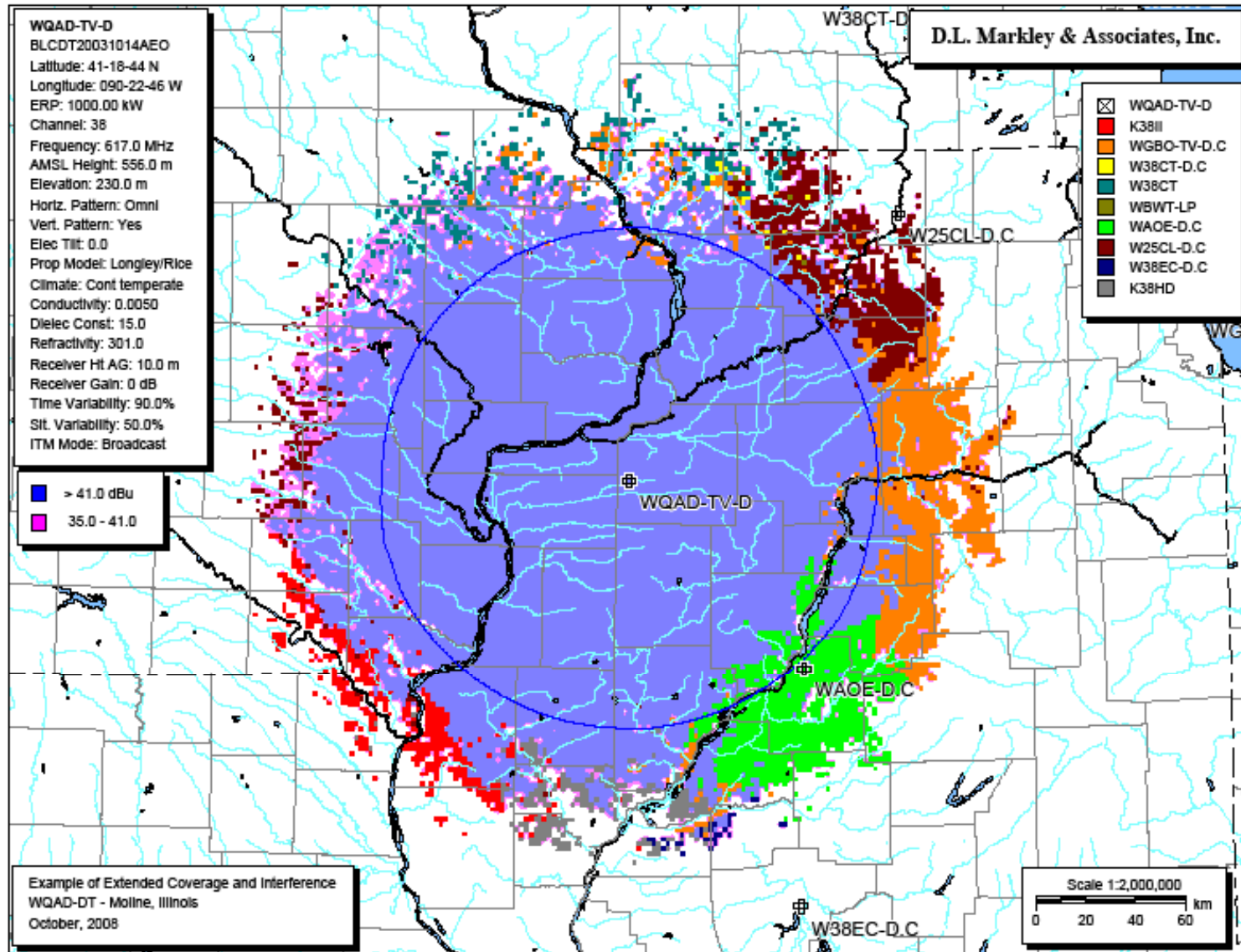
Examples – DTV Longley-Rice Coverage



Examples – DTV Extended L-R Coverage



Examples – DTV Extended L-R Coverage



Thank You!
Are there any questions?

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