

*NRSC  
REPORT*

# NATIONAL RADIO SYSTEMS COMMITTEE

**NRSC-R202  
First Adjacent Channel IBOC  
Interference Demonstration  
November 13, 2001**



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## NRSC-R202

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## **NRSC-R202**

### **FOREWORD**

NRSC-R202, First Adjacent Channel IBOC Interference Demonstration, documents a study undertaken for the NRSC to demonstrate a methodology for evaluating the impact of future IBOC operations on the analog operation of existing FM stations. The DAB Subcommittee chairman at the time of adoption of NRSC-R202 was Milford Smith; the NRSC chairman at the time of adoption was Charles Morgan.

The NRSC is jointly sponsored by the Consumer Electronics Association and the National Association of Broadcasters. It serves as an industry-wide standards-setting body for technical aspects of terrestrial over-the-air radio broadcasting systems in the United States.

**FIRST ADJACENT CHANNEL  
IBOC INTERFERENCE DEMONSTRATION  
PREPARED FOR  
NATIONAL RADIO SYSTEMS COMMITTEE**

INTRODUCTION

Evaluation of the potential first adjacent channel compatibility of hybrid IBOC FM stations with existing analog FM broadcast stations was an area of significant emphasis in the National Radio System Committee (NRSC) testing of iBiquity's IBOC system. This study was undertaken to demonstrate a methodology for evaluating the impact of future IBOC operations on the analog operation of existing FM stations. The results are not intended to be representative of the impact on all stations, since only six stations could be analyzed under the time constraints for the study, but rather are intended to illustrate how the subjective data collected in the NRSC testing can be applied to study the potential IBOC impact on individual stations.

The parameters employed in the study are based on subjective data for a speech formatted FM station received on an automobile radio. The speech format is the most demanding test for IBOC compatibility. The predicted IBOC first adjacent impact on station coverage for automobile radios receiving other station formats would likely be lower or indiscernible.

**DENNY & ASSOCIATES, P.C.**  
**CONSULTING ENGINEERS**  
**OXON HILL, MARYLAND**

IBOC Interference Demonstration  
National Radio Systems Committee

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STATIONS STUDIED

The six stations employed in the study were selected to reflect a variety of station classes, allocation scenarios, and terrain conditions. The following table lists the stations studied and the significant conditions that apply to each.

<u>Call Sign</u>	<u>Channel/ Class</u>	<u>ERP (kW)</u>	<u>HAAT (meters)</u>	<u>City, State</u>	Noncommercial	Commercial	Directional	Grandfathered Super Power	Grandfathered Short Spaced	Fully Spaced (Or Nearly)	Short Spaced (73.215)	Significant Terrain Advantage	<u>Terrain Conditions</u>			
													Flat	Moderate	Rough	
WETA	215B	75	186	Washington, DC	X			X						X		
KEGL	246C	100	508	Fort Worth, TX		X				X				X		
WKKJ	227B	50	106	Chillicothe, OH		X			X					X		
KFRR	281B	17	260	Woodlake, CA		X				X		X	X	X		X
WDCZ	274A	6	100	Webster, NY		X	X				X				X	
KZFO	221B1	25	95	Madera, CA		X								X		X

Several of the stations conditions are noteworthy. WETA was selected because it is a noncommercial station and is grandfathered with facilities in excess of the maximum permitted for a Class B station. Noncommercial stations are protected to the FCC predicted 60 dBu F(50,50) contour regardless of class based on their licensed facilities. KFRR was selected because it is has a

significant height above average terrain advantage to the south and west in the direction of two first adjacent stations.

WDCZ is an example of an extreme interference condition. WDCZ is short spaced to WTSS, Buffalo, New York, pursuant to Section 73.215 of the FCC Rules. In addition, WTSS is a Class B station grandfathered with facilities of 110 kilowatts ERP and antenna radiation center HAAT of 408 meters which are far in excess of the maximum facilities of 50 kilowatts and 150 meters permitted for a Class B station. Thus, the interference predicted to WDCZ from WTSS in the studies herein represents an extreme case and is not representative of the interference predicted to Class A stations or stations employing contour protection pursuant to Section 73.215 of the FCC Rules.

#### METHODOLOGY AND STUDY PARAMENTERS

The First Adjacent Channel IBOC Interference Demonstration is based on an adapted version of the Federal Communications Commission program for calculating service and interference areas for digital television. The program calculates field strength and interference conditions for analog and IBOC operations over a grid of nearly square cells. A detailed description of the study methodology provided by the software contractor, Techware Inc., is attached.

The desired-to-undesired (D/U) signal strength ratios for first adjacent hybrid IBOC-to-analog and analog-to-analog employed in the studies were

derived from subjective data results from the NRSC testing. The subjective data results were analyzed by David Wilson of the Consumer Electronics Association for the NRSC. Based on the subjective analysis, a hybrid IBOC-to-analog D/U ratio of 6 dB applies for a speech formatted station received on an automobile radio. The results of the subjective tests suggest that the analog-to-analog D/U ratio for a speech formatted station is more negative than -4 dB. However, the limited D/U data collected does not allow the D/U ratio to be precisely determined. Therefore, an analog-to-analog D/U ratio of -4 dB was used in the analysis.

An analog-to-analog cochannel D/U ratio of 20 dB from the FCC Rules was used to evaluate existing cochannel analog interference. It was unnecessary to evaluate cochannel hybrid IBOC-to-analog interference since interference from the analog portion of a hybrid IBOC operation would mask any interference from the IBOC portion.

For each station two studies were performed using different limiting contours. The limiting contours were determined using the FCC's contour prediction methodology. These limiting contours define the boundary of the study. The first limiting contour is the protected contour for the station under study. The second study was limited at the 40 dBu contour, which was selected as the rough limit of automobile radio reception.

## RESULTS

The results of the studies for each station consist of a tabulation detailing the populations and areas for the various conditions studied and two maps, one for each of the limiting contours employed. The population data employed in the study are from 1990 US Census and are not intended to represent actual station listeners. Similarly, the interference predictions and percentages shown in the tabulations are referenced to the US Census data and do not represent impact on actual station listeners.

Each of the maps depicts the predicted areas of existing cochannel and first adjacent channel analog interference as well as potential IBOC interference from first adjacent channel hybrid IBOC stations. The maps also show the Longley-Rice predicted signal strength within the limiting FCC contour at locations where no interference is predicted. The maps are intended to be used only as a guide to determine general areas where interference may occur. Since signal propagation is statistical in nature and propagation models are not capable of accounting for all the factors that may affect coverage, the maps should not be used as an absolute determination of coverage or interference.



# TechWare, Inc.

## Evaluation of IBOC Impact on Analog FM Service November 13, 2001

### Methodology

An In Band on Channel digital transmission system for the FM broadcast band (IBOC) has been proposed by iBiquity Digital Corporation. As part of the evaluation to determine the feasibility of the proposed system an analysis was performed to assess the predicted impact of the system on existing analog reception.

The evaluation was based on the following parameters and assumptions.

1. Each existing full service FM broadcast station will implement the IBOC system.
2. The power and antenna height for each station was as listed in the FCC's FM broadcast station database. In the case where multiple records existed for the same station the parameters were selected based on the following hierarchy: Construction Permit, License, Application. The only exceptions to this being for the six stations that were evaluated. Their parameters were as provided by the NAB's consultant.
3. Vertical polarization was assumed for both transmit and receive antennas
4. Any directional transmit horizontal antenna patterns listed in the FCC database were considered
5. No vertical antenna patterns were considered
6. The receive antenna for Longley-Rice analyses was assumed to be non-directional and 2 meters above ground level
7. Protected contours were computed using the FCC F50/50 curves and the height above average terrain for the standard evenly spaced 8 radials.
8. Within the protected contours service and interfering fields were computed using the Longley-Rice propagation model.
9. Longley-Rice service fields were computed on the basis of F50/50 while interfering field computations were for F50/10.
10. Population counts based on 1990 census data
11. Terrain data was 3 second USGS data
12. Longley-Rice flags indicating potentially unreliable predictions were ignored (Experience has indicated that these predictions are usually in line with what is expected for the point in question)
13. The potential interfering stations that were considered in the Longley-Rice analysis were determined by selecting stations that are within 1.5 times the normal separation distance required by the FCC. Analog stations on the same and 1<sup>st</sup> adjacent channels were selected. Potential IBOC interference was calculated from those stations whose analog channel is on the 1<sup>st</sup> adjacent channel from the protected station.

14. Required desired-to-undesired (D/U) field strengths were as provided by the NAB's consultant ( 20 dB analog-to-analog co-channel, -4 dB analog-to-analog 1<sup>st</sup> adjacent channel, and 6 dB 1<sup>st</sup> adjacent channel IBOC-to-analog. No IBOC-to-analog co-channel evaluation was made since it is assumed that any interference would always be masked by the analog-to-analog interference)
15. Two sets of analyses were performed. The first set assumed the field strength required for service was the same as the FCC protected contour for the class of station being analyzed. The second set assumed 40 dB $\mu$  as the field strength required for service.

The actual prediction of coverage and interference within the protected contours was determined by dividing the area into a grid of essentially square cells 0.5 km on a side (0.25 square km). For each cell a determination was made as to the census blocks (the smallest subdivision of census data) that were within that cell and then a geographic point for calculation purposes was determined by finding the centroid of the population within the cell. This grid methodology is the same as the FCC used in its DTV planning.

At each grid point the predicted field strength for the protected station and the potential interfering stations was made using the Longley-Rice propagation model. At each point where the service prediction was above the service threshold a determination was made of the ratio of the desired signal to each potential interfering signal (D/U ratio) to determine if interference would be expected for that cell.

From the analysis four service predictions are provided. The first is the population and area within the predicted contour and the second is the population and area that is not lost to terrain obstructions (as determined by the Longley-Rice model). The next is the population and area not lost to terrain and/or analog interference (service without IBOC) and finally the population and area considering all terrain and interference losses (with IBOC).

For each of the stations considered two maps have been provided, one assuming the FCC protected contour as the required level of service and a second based on 40 dB $\mu$ . The 40 dB $\mu$  map also shows the FCC protected contour. Points on each map where the service prediction was at or above the assumed minimum and the D/U ratio was above the level at which interference is expected are indicated by a sliding color scale that depicts the predicted field strength at the point. Points where the D/U ratio indicates interference is expected are denoted in either red (analog interference) or blue (IBOC interference). It should be noted that the blue areas indicating IBOC interference would show service in the absence of IBOC. In other words the IBOC interference is not masking any analog interference.

**WETA WASHINGTON DC 215 B**

Site location 38 53 30 77 07 55

Power 75.00000

RCAMSL 252.000

Antenna Rotation 0.0 Antenna ID 0

FCC Predicted contour 60 dBu (Protected)

Station type Analog

	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	4,580,172	11,212.53				
Within Terrain Limited (Longley-Rice)	4,289,282	9,663.92	0.00	0.00		
Interference limited service without IBOC	4,260,075	9,636.49	-0.68	-0.28		
Interference limited service with IBOC	4,237,066	9,603.08	-1.22	-0.63	-0.54	-0.35

**WETA WASHINGTON DC 215 B**

Site location 38 53 30 77 07 55

Power 75.00000

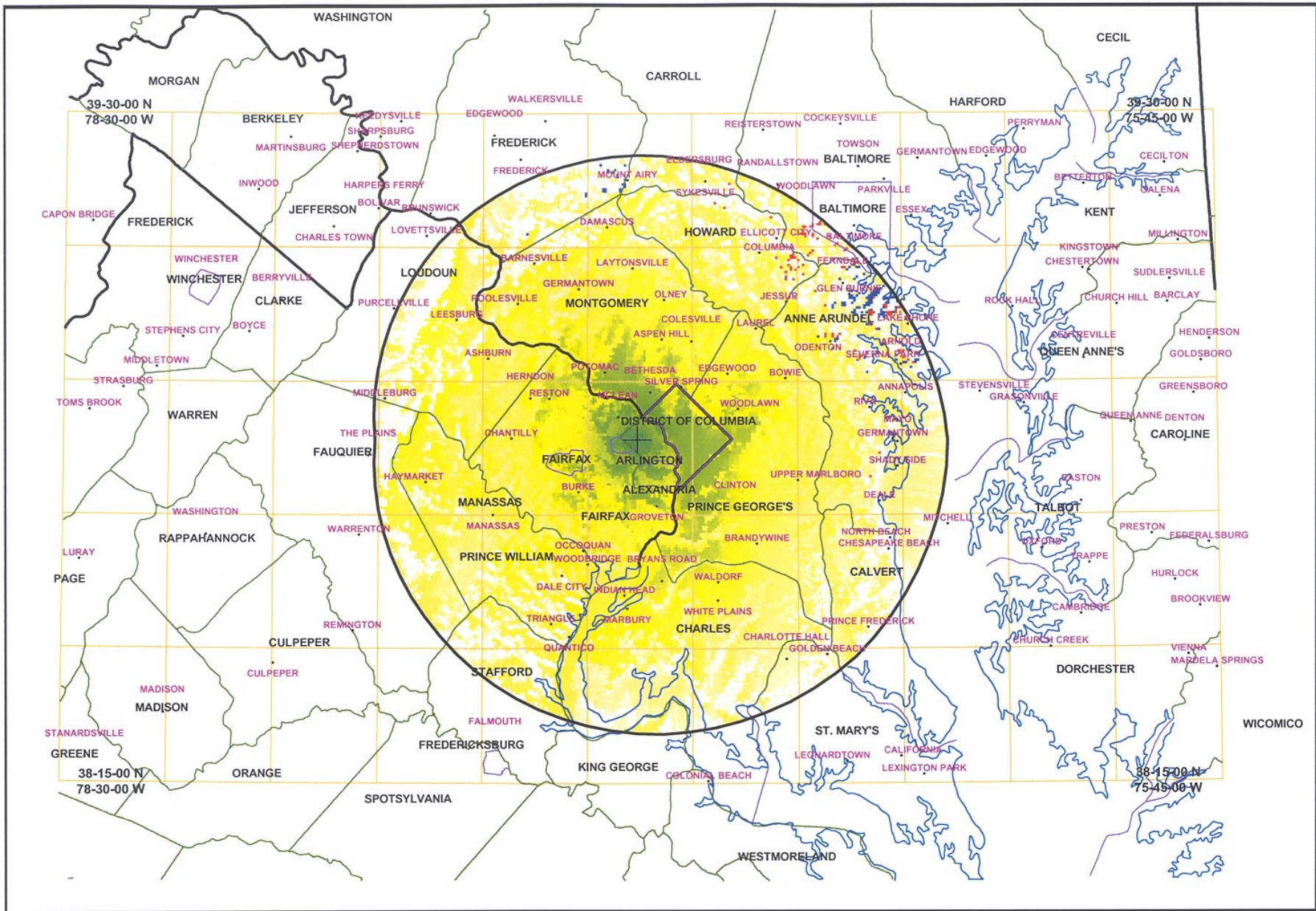
RCAMSL 252.000

Antenna Rotation 0.0 Antenna ID 0

FCC predicted contour 40 dBu

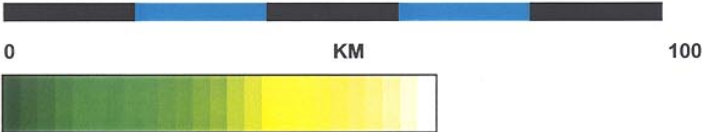
Station type Analog

	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	7,072,619	36,822.02				
Within Terrain Limited (Longley-Rice)	6,746,709	31,448.85	0.00	0.00		
Interference limited service without IBOC	5,763,553	23,779.69	-14.57	-24.39		
Interference limited service with IBOC	5,508,418	20,792.02	-18.35	-33.89	-3.78	-9.50



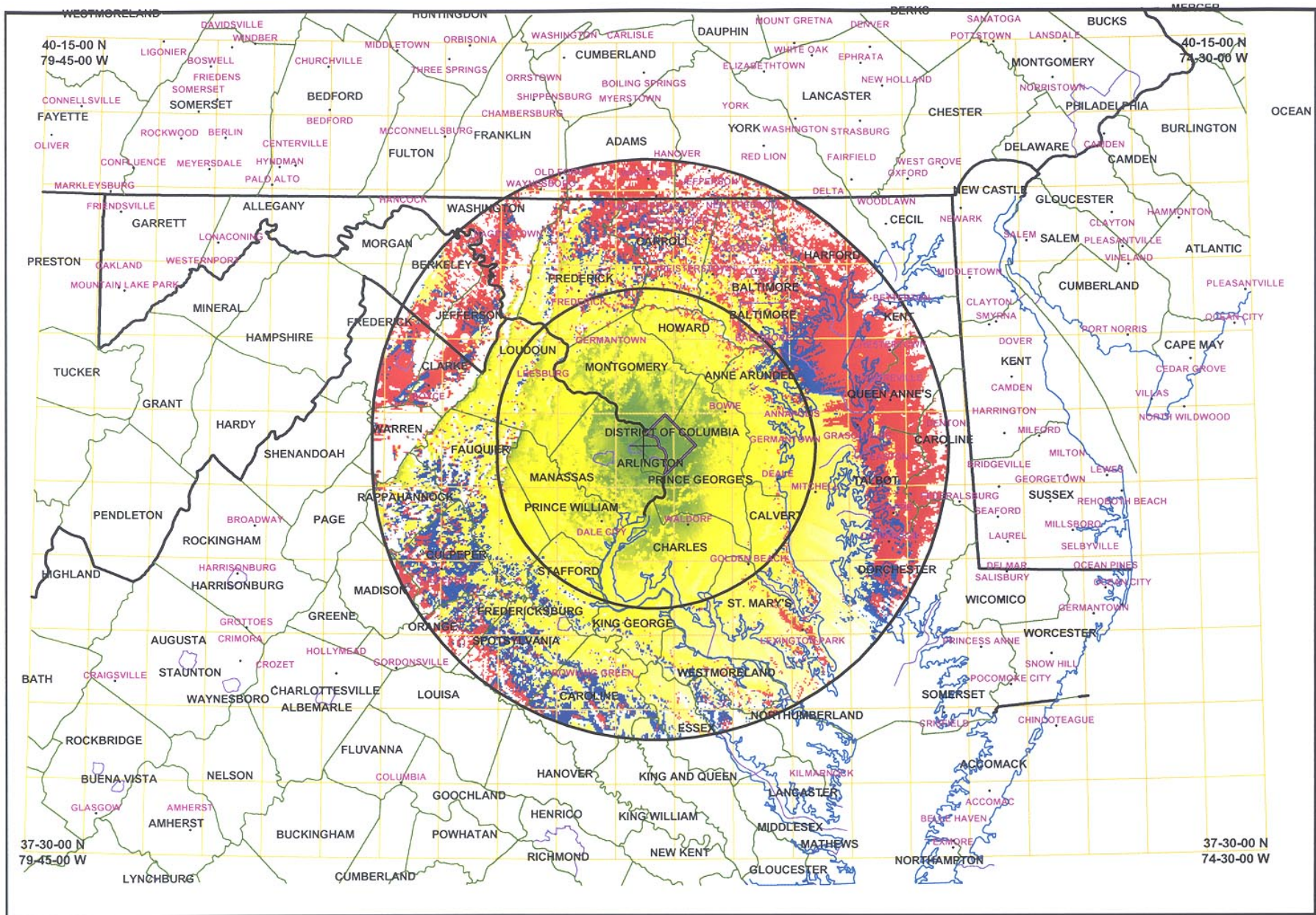
Contour is 60 dBu

WETA WASHINGTON DC Analog FM Channel 215  
 Interference: Analog = RED Digital = BLUE



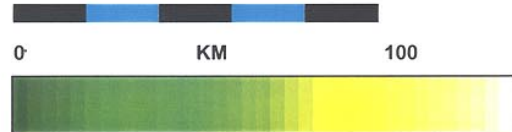
146.08 dBu      103.04 dBu      60 dBu  
 Predicted Longley-Rice Field

Prepared for NAB  
 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842



Contours are 40 and 60 dBu

WETA WASHINGTON DC Analog FM Channel 215  
 Interference: Analog = RED Digital = BLUE



143.68 dBu                      91.84 dBu                      40 dBu  
 Predicted Longley-Rice Field

Prepared for NAB  
 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842

**KEGL FORT WORTH TX 246 C**

Site location 32 35 19 96 58 05

Power 100.00000

RCAMSL 697.000

Antenna Rotation 0.0 Antenna ID 0

FCC Predicted contour 60 dBu (Protected)

Station type Analog

	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	3,993,478	23,812.18				
Within Terrain Limited (Longley-Rice)	3,940,454	21,132.26	0.00	0.00		
Interference limited service without IBOC	3,939,849	21,071.47	-0.02	-0.29		
Interference limited service with IBOC	3,939,849	21,071.47	-0.02	-0.29	0.00	0.00

**KEGL FORT WORTH TX 246 C**

Site location 32 35 19 96 58 05

Power 100.00000

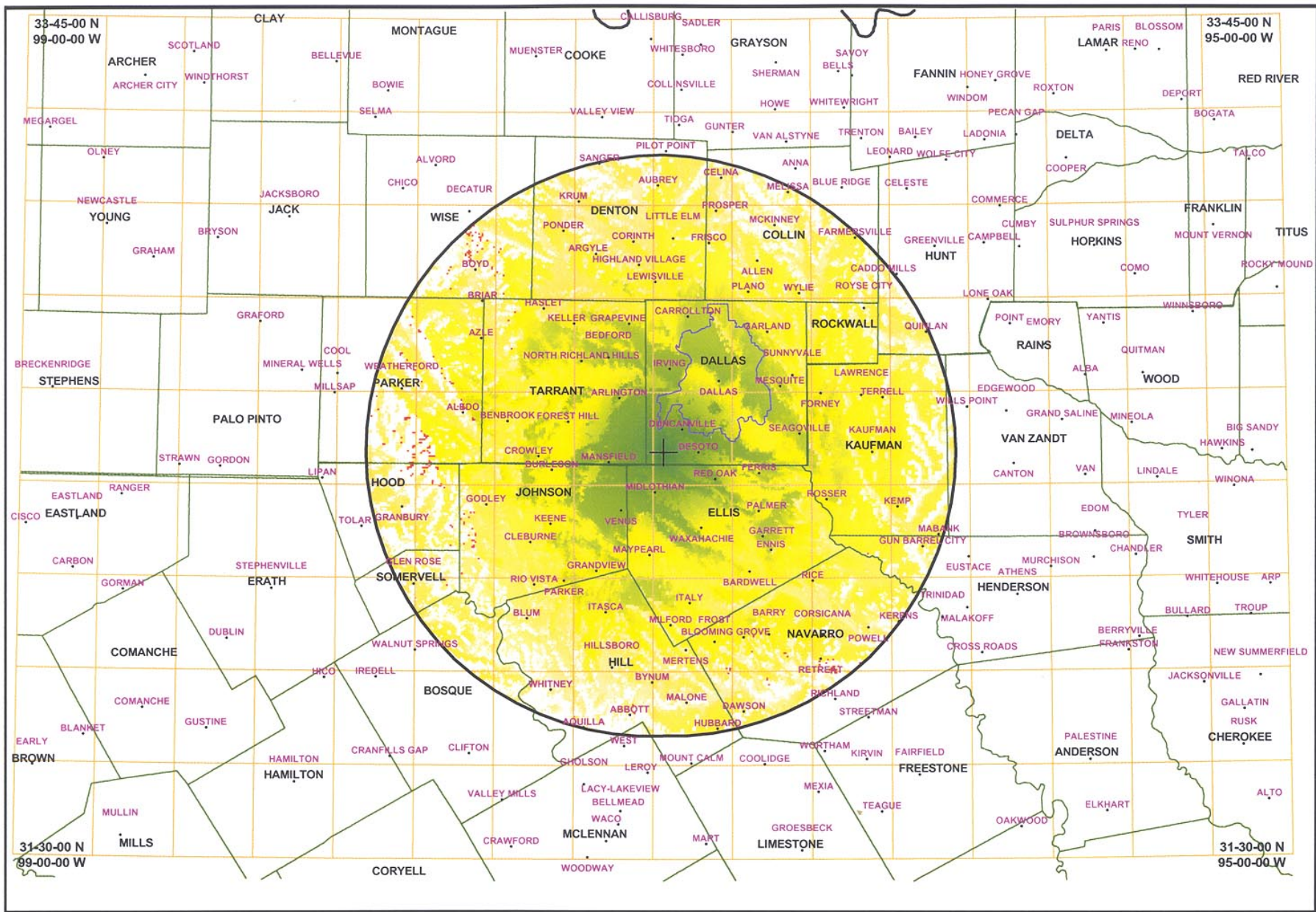
RCAMSL 697.000

Antenna Rotation 0.0 Antenna ID 0

FCC predicted contour 40 dBu

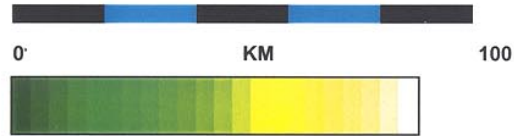
Station type Analog

	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	4,703,497	65,265.70				
Within Terrain Limited (Longley-Rice)	4,642,371	57,753.20	0.00	0.00		
Interference limited service without IBOC	4,241,562	37,823.20	-8.63	-34.51		
Interference limited service with IBOC	4,229,247	36,726.70	-8.90	-36.41	-0.27	-1.90



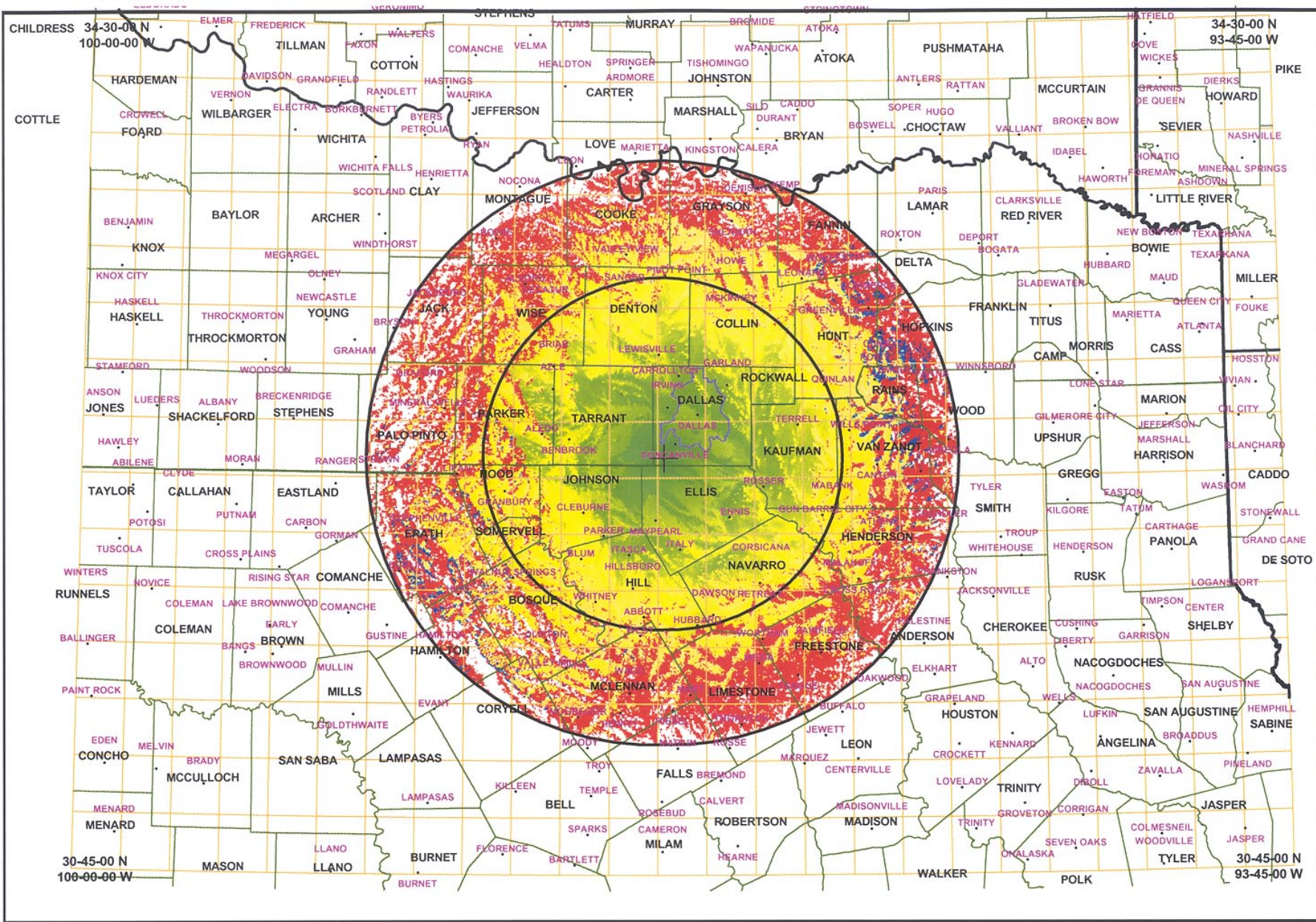
Contour is 60 dBu

**KEGL FORT WORTH TX Analog FM Channel 246**  
**Interference: Analog = RED Digital = BLUE**



140.87 dBu      100.435 dBu      60 dBu  
 Predicted Longley-Rice Field

Prepared for NAB  
 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842



Contours are 40 and 60 dBu

KEGL FORT WORTH TX Analog FM Channel 246  
 Interference: Analog = RED Digital = BLUE



Prepared for NAB  
 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842

141.23 dBu      90.615 dBu      40 dBu  
 Predicted Longley-Rice Field



**WKKJ CHILLICOTHE OH 227 B**

Site location 39 19 52 82 59 49

Power 50.00000

RCAMSL 343.000

Antenna Rotation 0.0 Antenna ID 0

FCC Predicted contour 54 dBu (Protected)

Station type Analog

	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	341,902	10,292.70				
Within Terrain Limited (Longley-Rice)	268,725	8,331.98	0.00	0.00		
Interference limited service without IBOC	220,096	6,730.06	-18.10	-19.23		
Interference limited service with IBOC	219,769	6,695.40	-18.22	-19.64	-0.12	-0.42

**WKKJ CHILLICOTHE OH 227 B**

Site location 39 19 52 82 59 49

Power 50.00000

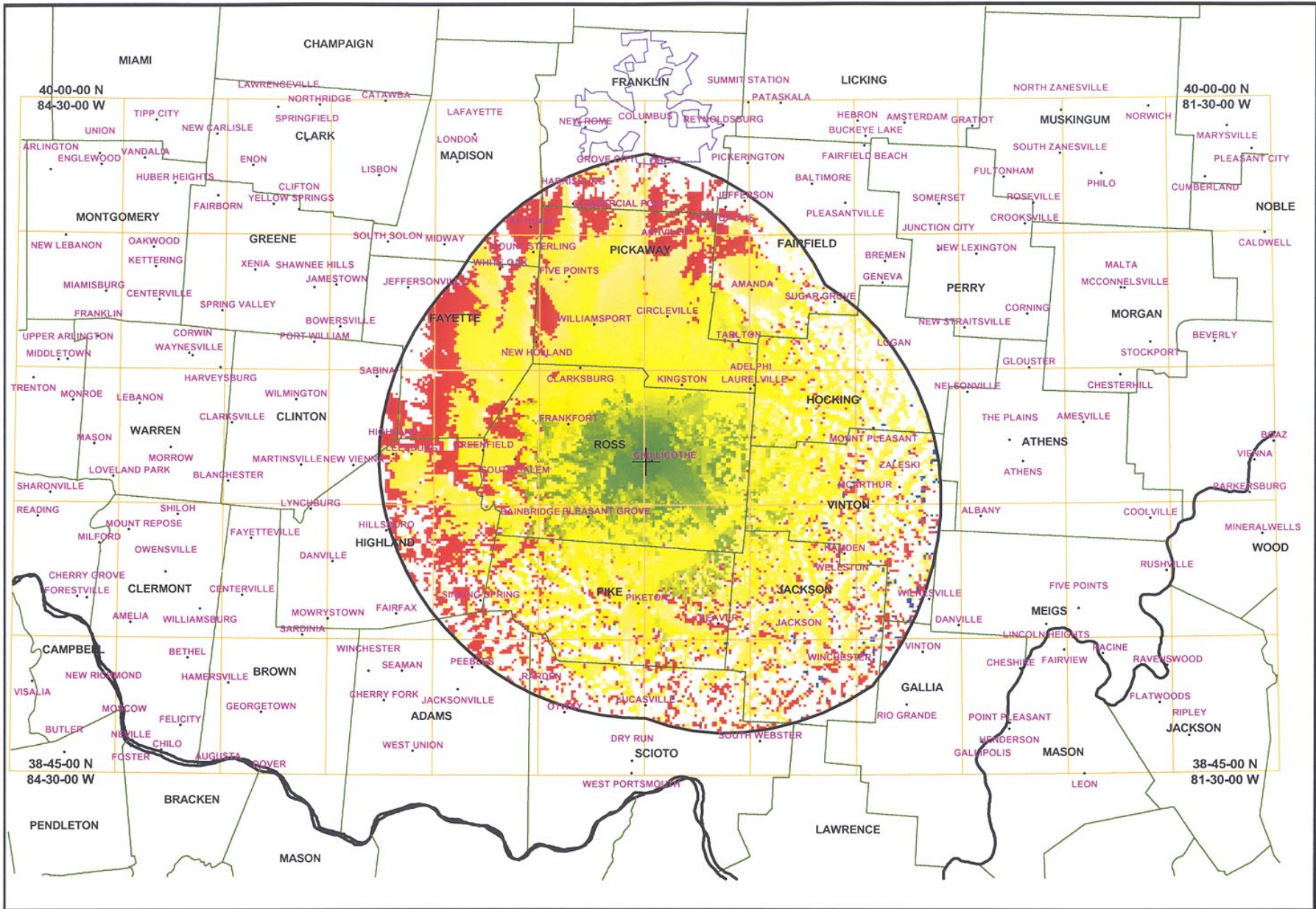
RCAMSL 343.000

Antenna Rotation 0.0 Antenna ID 0

FCC predicted contour 40 dBu

Station type Analog

	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	1,781,718	25,718.42				
Within Terrain Limited (Longley-Rice)	1,613,749	20,836.41	0.00	0.00		
Interference limited service without IBOC	425,323	8,513.79	-73.64	-59.14		
Interference limited service with IBOC	421,427	8,269.89	-73.89	-60.31	-0.24	-1.17



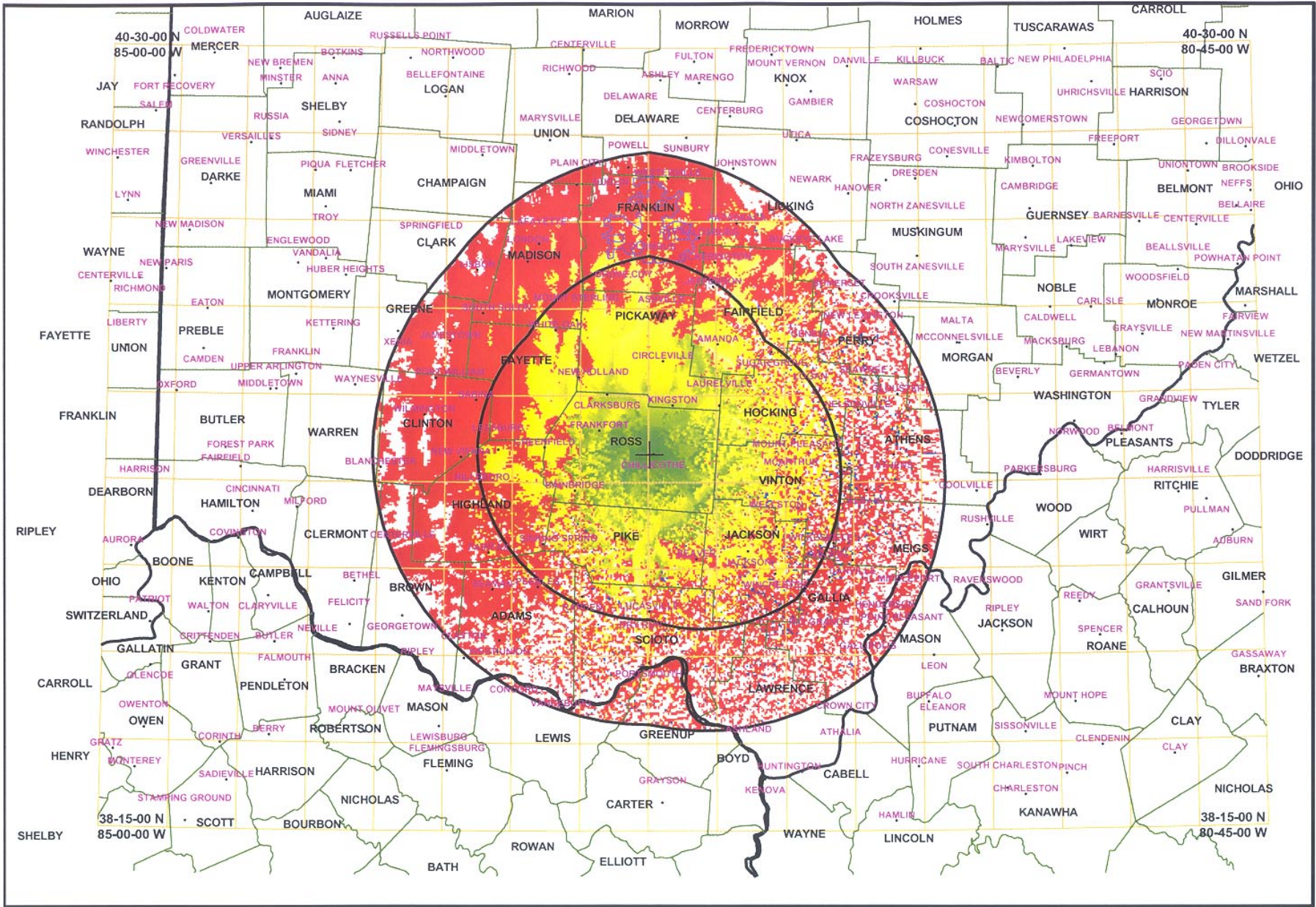
Contour is 64 dBu

WKKJ CHILLICOTHE OH Analog FM Channel 227  
 Interference: Analog = RED Digital = BLUE



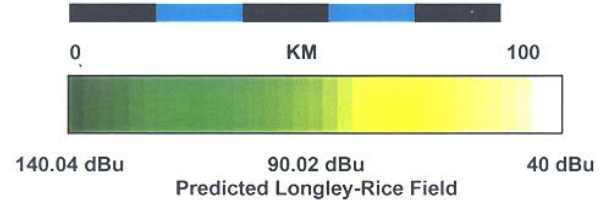
138.88 dBu      96.44 dBu      54 dBu  
 Predicted Longley-Rice Field

Prepared for NAB  
 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842



Contours are 40 and 54 dBu

WKKJ CHILLICOTHE OH Analog FM Channel 227  
 Interference: Analog = RED Digital = BLUE



Prepared for NAB  
 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842

**KFRR WOODLAKE CA 281 B**

Site location 36 38 12 118 56 34

Power 17.00000

RCAMSL 1590.000

Antenna Rotation 0.0 Antenna ID 0

FCC Predicted contour 54 dBu (Protected)

Station type Analog

	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	1,016,230	16,973.05				
Within Terrain Limited (Longley-Rice)	1,003,587	12,362.63	0.00	0.00		
Interference limited service without IBOC	1,000,996	11,309.65	-0.26	-8.52		
Interference limited service with IBOC	997,129	11,099.00	-0.64	-10.22	-0.39	-1.70

**KFRR WOODLAKE CA 281 B**

Site location 36 38 12 118 56 34

Power 17.00000

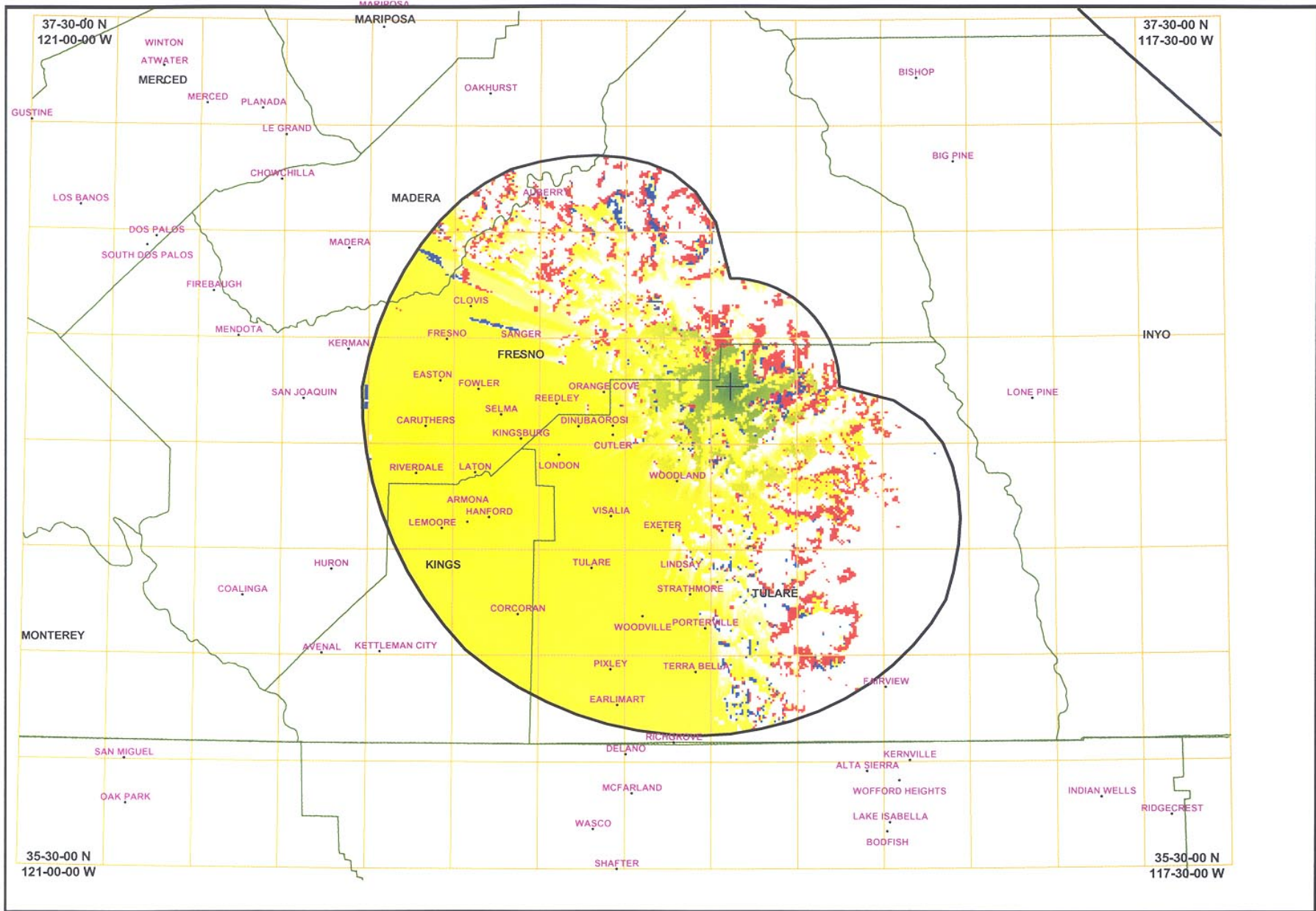
RCAMSL 1590.000

Antenna Rotation 0.0 Antenna ID 0

FCC predicted contour 40 dBu

Station type Analog

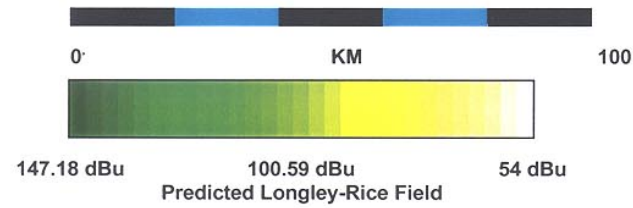
	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	1,218,879	36,546.96				
Within Terrain Limited (Longley-Rice)	1,186,096	27,116.75	0.00	0.00		
Interference limited service without IBOC	1,152,572	21,894.95	-2.83	-19.26		
Interference limited service with IBOC	1,145,032	20,923.03	-3.46	-22.84	-0.64	-3.58

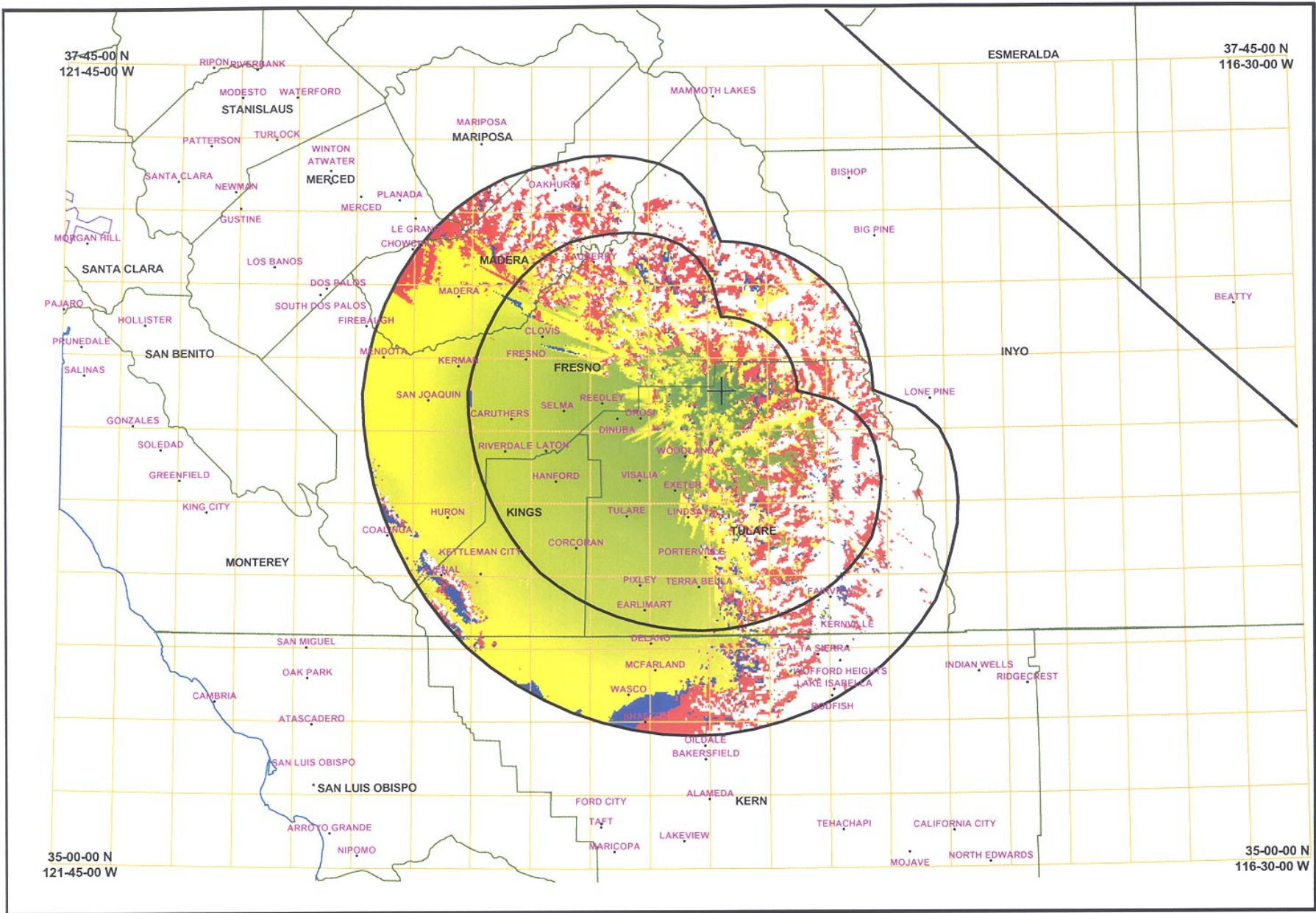


**Contour is 64 dBu**

**KFRR WOODLAKE CA Analog FM Channel 281**  
**Interference: Analog = RED Digital = BLUE**

Prepared for NAB  
 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842

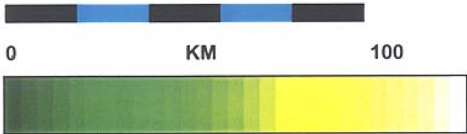




**Contours are 40 and 64 dBu**

**KFRR WOODLAKE CA Analog FM Channel 281**  
**Interference: Analog = RED Digital = BLUE**

Prepared for NAB  
 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842



Predicted Longley-Rice Field

**WDCZ-FM WEBSTER NY 274 A**

Site location 43 10 14 77 40 23

Power 6.00000

RCAMSL 241.000

Antenna Rotation 0.0 Antenna ID 14894

FCC Predicted contour 60 dBu (Protected)

Station type Analog

	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	691,012	2,183.63				
Within Terrain Limited (Longley-Rice)	686,996	2,127.63	0.00	0.00		
Interference limited service without IBOC	675,317	2,060.39	-1.70	-3.16		
Interference limited service with IBOC	642,035	1,854.25	-6.54	-12.85	-4.84	-9.69

**WDCZ-FM WEBSTER NY 274 A**

Site location 43 10 14 77 40 23

Power 6.00000

RCAMSL 241.000

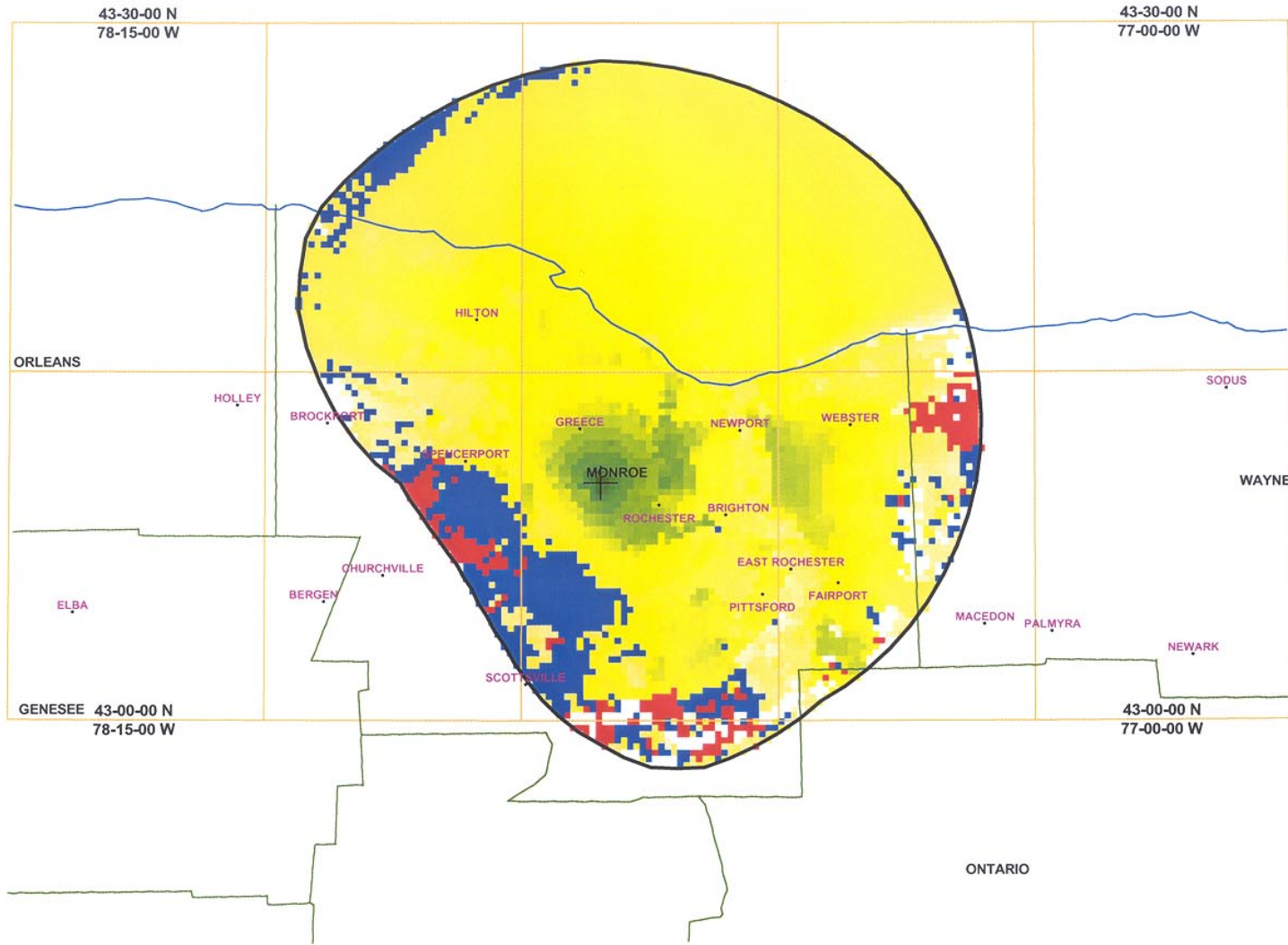
Antenna Rotation 0.0 Antenna ID 14894

FCC predicted contour 40 dBu

Station type Analog

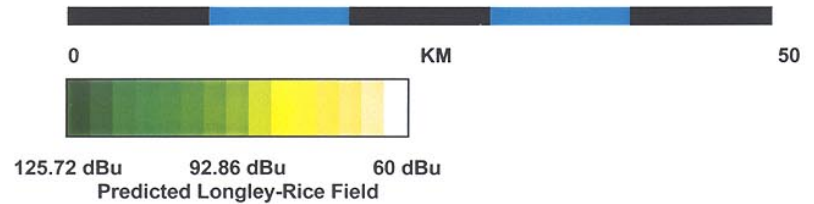
	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	960,204	12,683.90				
Within Terrain Limited (Longley-Rice)	924,205	11,583.61	0.00	0.00		
Interference limited service without IBOC	756,200	5,743.90	-18.18	-50.41		
Interference limited service with IBOC	669,778	3,567.76	-27.53	-69.20	-9.35	-18.79

**Contour is 60 dBu**

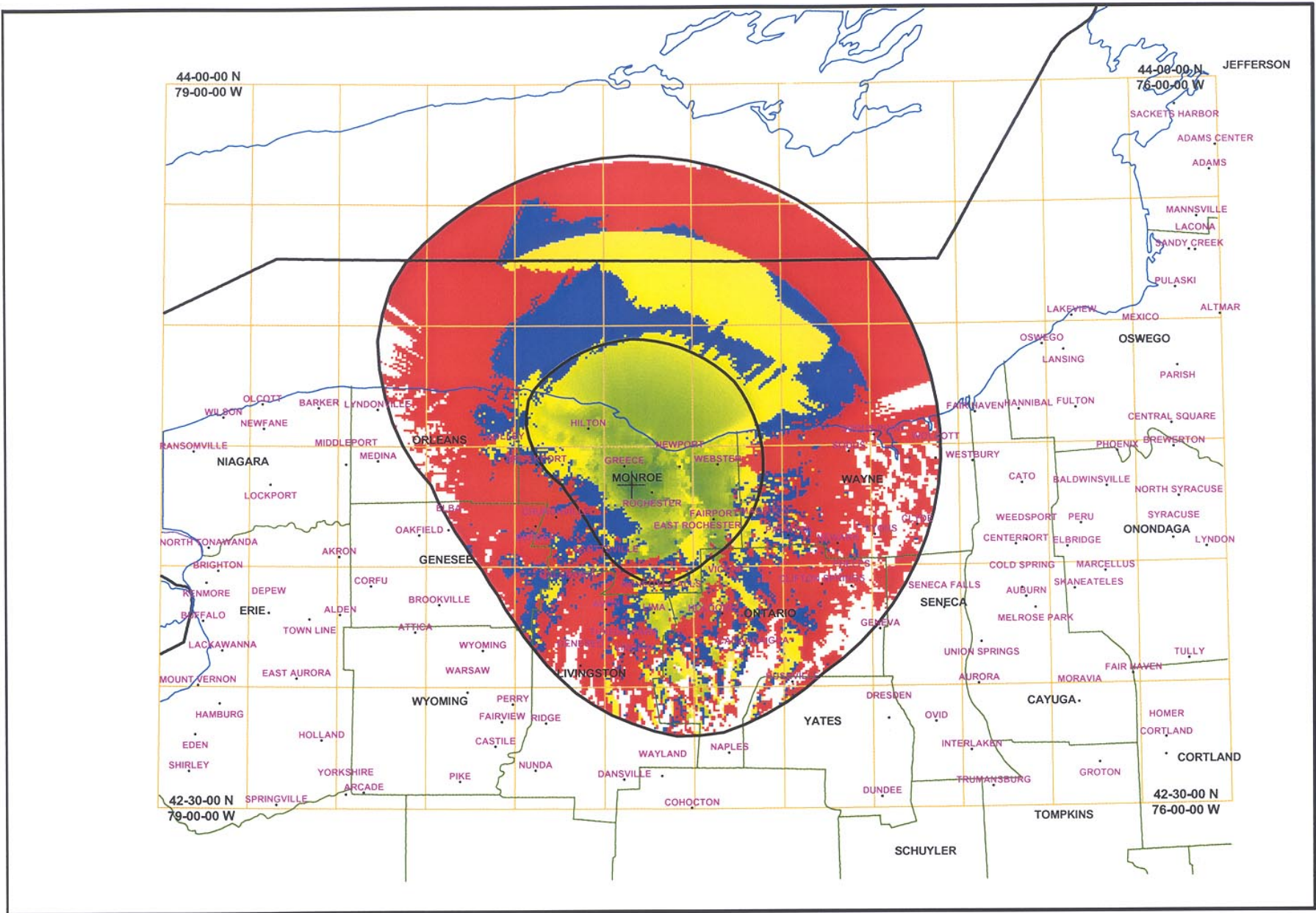


WDCZ-FM WEBSTER NY Analog FM Channel 274  
Interference: Analog = RED Digital = BLUE

Prepared for NAB  
Prepared by TechWare, Inc. Chantilly, VA 703-222-5842

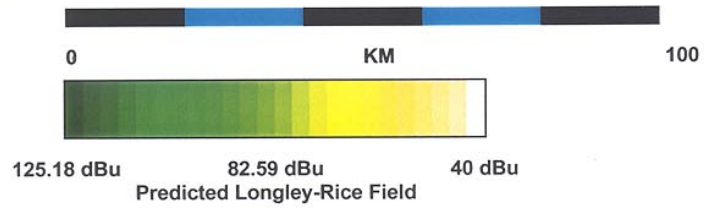






**Contours are 40 and 60 dBu**

**WDCZ-FM WEBSTER NY Analog FM Channel 274**  
**Interference: Analog = RED Digital = BLUE**



Prepared for NAB  
 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842

**KZFO MADERA CA 221 B1**

Site location 36 57 58 120 02 06

Power 25.00000

RCAMSL 179.000

Antenna Rotation 0.0 Antenna ID 0

FCC Predicted contour 57 dBu (Protected)

Station type Analog

	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	589,412	5,952.21				
Within Terrain Limited (Longley-Rice)	564,746	5,338.39	0.00	0.00		
Interference limited service without IBOC	564,746	5,332.05	0.00	-0.12		
Interference limited service with IBOC	564,746	5,331.56	0.00	-0.13	0.00	-0.01

**KZFO MADERA CA 221 B1**

Site location 36 57 58 120 02 06

Power 25.00000

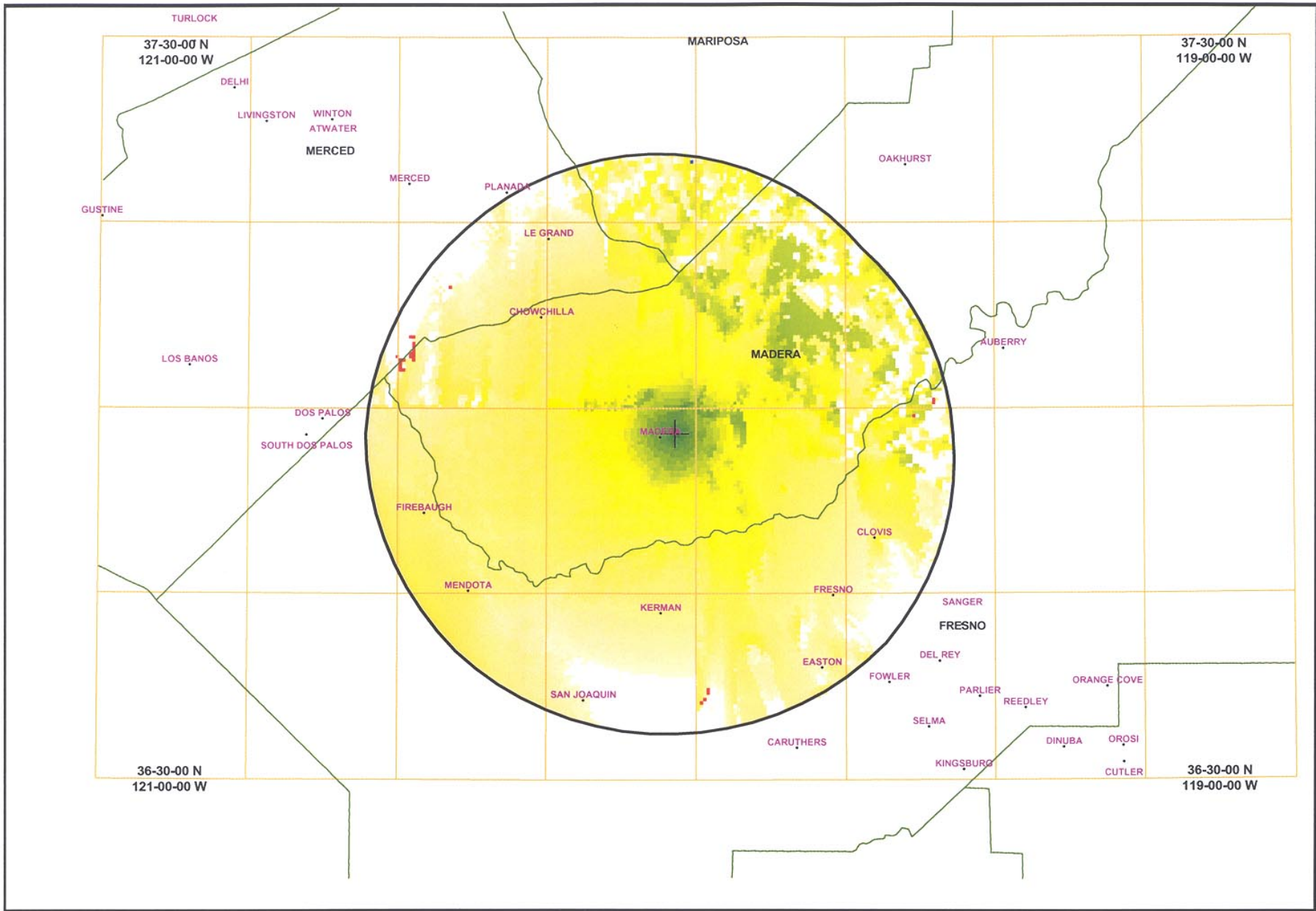
RCAMSL 179.000

Antenna Rotation 0.0 Antenna ID 0

FCC predicted contour 40 dBu

Station type Analog

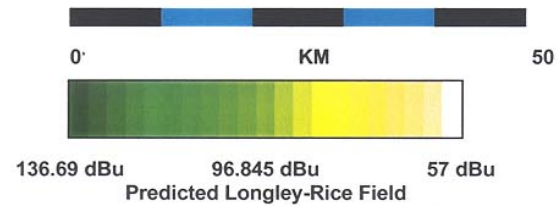
	<u>Population</u>	<u>Area (Sq km)</u>	<u>Percent Change From Terrain Limited Population</u>	<u>Percent Change From Terrain Limited Area</u>	<u>Differential In Percent Change For Population IBOC-OFF/IBOC-ON</u>	<u>Differential In Percent Change For Area IBOC-OFF/IBOC-ON</u>
Within FCC Predicted Contour	1,009,320	20,964.94				
Within Terrain Limited (Longley-Rice)	945,263	17,668.53	0.00	0.00		
Interference limited service without IBOC	777,187	13,393.83	-17.78	-24.19		
Interference limited service with IBOC	770,766	13,163.94	-18.46	-25.49	-0.68	-1.30

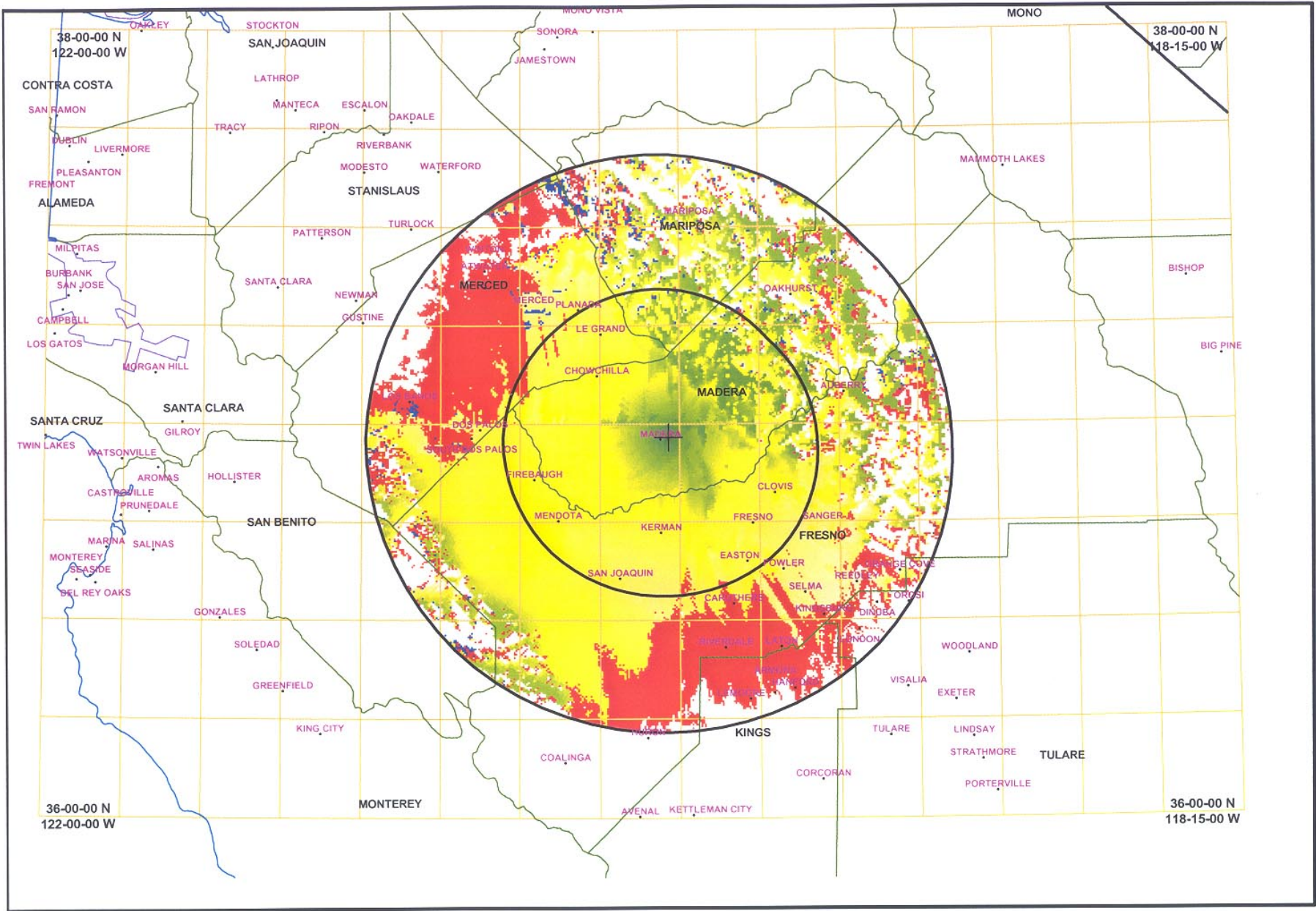


**Contour is 67 dBu**

**KZFO MADERA CA Analog FM Channel 221**  
**Interference: Analog = RED Digital = BLUE**

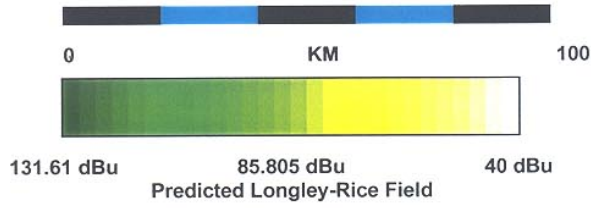
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**Contours are 40 and 57 dBu**

**KZFO MADERA CA Analog FM Channel 221**  
**Interference: Analog = RED Digital = BLUE**



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 Prepared by TechWare, Inc. Chantilly, VA 703-222-5842

NRSC-R202

NRSC Document Improvement Proposal

If in the review or use of this document a potential change appears needed for safety, health or technical reasons, please fill in the appropriate information below and email, mail or fax to:

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c/o Consumer Electronics Association  
Technology & Standards Department  
1919 S. Eads St.  
Arlington, VA 22202  
FAX: 703-907-4190  
Email: [standards@ce.org](mailto:standards@ce.org)

DOCUMENT NO.	DOCUMENT TITLE:	
SUBMITTER'S NAME:	TEL:	
COMPANY:	FAX:	
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URGENCY OF CHANGE: _____ Immediate _____ At next revision		
PROBLEM AREA (ATTACH ADDITIONAL SHEETS IF NECESSARY): a. Clause Number and/or Drawing: b. Recommended Changes: c. Reason/Rationale for Recommendation:		
ADDITIONAL REMARKS:		
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