

**Station WILV (100.3 MHz) AON Building, Chicago
Robert Rose. Field Trip Report**

This report is prepared to provide radio station WILV information concerning its operation from the AON Building Chicago, Illinois. The data used in the report is based on measurements and notes recorded as part of a FM Master Antenna performance check. The trip was performed in September 29, 2012 under Electronic Research Inc. Project No. 09846V. Station WDRV engineer, Kent Lewin organized the ERI trip and assisted in obtaining the information used within this report. The report includes one enclosure Titled: Figure 3, Spectrum Analyzer Sweep (20 MHz. Span)

WILV Analog (100.3MHz) Consideration in using at the AON site for broadcasting.

WILV will share the AON Master FM Antenna with WDRV in the future. To judge their mutual operation, power testing was performed that required the following information items 1 thru 8 be gathered. Therefore; using "WDRV" transmission layout similarities WILV's Transmitter Power Output (TPO) is calculated from items below.

- (1) Effective Radiated Power: 6.9 kW (FCC Mandated)
- (2) Antenna Power Gain: 1.535 (Cogwheel Model No. 1183-3CP-DA)
- (3) Antenna Input Power Requirement: 4,494 Watts
- (4) Combiner Loss: -0.30 dB (obtained from July 11, 2008 power analysis)
- (5) Feed line 1 (transmitter to combiner 32.27' of MYAT 301*: -0.030 dB
- (6) Feed line 2 (combiner to tower-base 144.7' of MYAT 401*: -0.107 dB
- (7) Feed line 3 (tower base to antenna 66.26' of HJ12-50*: -0.112 dB
- (8) RH to LH operating mode coupling loss: -0.006 dB

WILV Analog Calculations:

- (9) Total system losses: -0.555 dB
- (10) Efficiency: 88.0 %
- (11) System Power loss: 629.16 Watts
- (12) Transmitter Output Power (TPO) = 5,106.6 Watts

*** Feed Line Information:**

Rigid MYAT Type 401: 0.074 dB loss per 100 feet @ 100.3 MHz

Rigid MYAT Type 301: 0.093 dB loss per 100 feet @ 100.3 MHz

Cable Andrew HJ12-50: 0.169dB loss per 100 feet @ 100.3 MHz

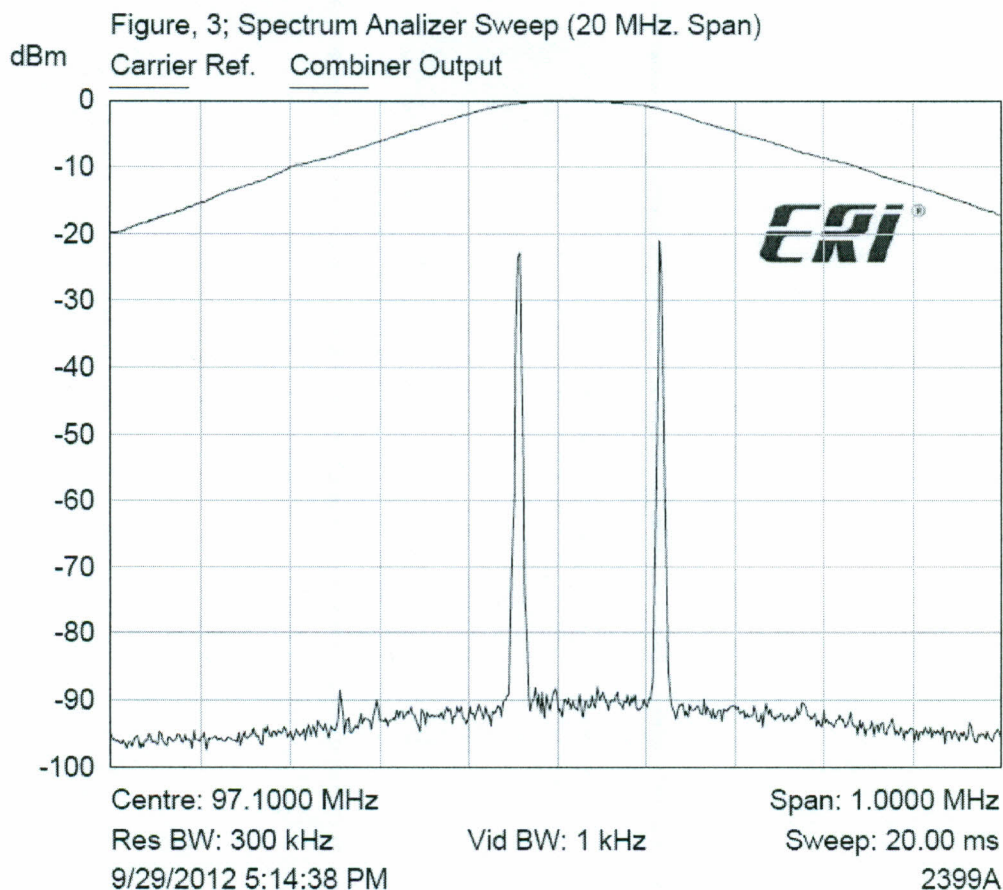
IM Verification Check:

IM Emissions and Occupied Bandwidth investigations were conducted using calibrated directional couplers located at analog combiner output port with the antenna system operated under permitted power levels. Particular attention was paid to emissions of the third order type. The formula $2F_1 - F_2$ determined that the mixing of 97.1 MHz and 100.3 MHz might cause two products at 93.9 MHz 103.5 MHz, introducing them into the transmission system if sufficient combiner isolation is not met, however, the selectiveness of the Band-Pass filtering used within each station's combiner module facilitated meeting the -80 dB FCC mandated requirement



Conclusion,

For FCC compliance verification, refer to spectrum analyzer measured trace (Figure 3) this trace illustrates performance using the limit trace labeled Carrier Ref. This trace has been positioned at the graphs 0 dB reference line. The trace labeled "Combiner Output" provides measurement validation of third order IM product conformity. In other words, to conduct a meaningful measurement, the trace is referenced against the higher of WDRV's & WILV's forward carrier frequency levels using the spectrum analyzers top graticule as point-of-reference. Shown in the noise of Figure,3 wide, 20 MHz sweep are the two possible $2F_1-F_2$ emissions that fall on two local stations operating at 93.9 MHz and 103.5 MHz. The trace shows no evidence of emission exceeding the -80 dB despite the operation of the two local stations broadcasting from the Willis (Sears) building nearby. The principal mission of my investigation was to collect data and offer the data as proof that WDRV and WILV is operating in complete compliance of FCC rules and regulations 73.317 sections B thru D. Therefore I find that the system is in good working order and no spurious emissions radiated from the antenna.



The two traces provide measurement validation of third order IM product compliance. In order to conduct a meaningful measurement, the trace is referenced against the higher of the two WDRV's & WILV's forward carrier frequency level using the spectrum analyzers top graticule as point-of-reference. The *Carrier Ref.* trace data reflects this setup. The Spectrum Analyzer was then setup to conduct a 20 MHz. wide sweep of the FM band without changing the Analyzers CPL. This sweep is overlaid on the *Carrier Ref.* trace.

Shown within Figure 2, Trace labeled: "Combiner Output" are the two possible $2F_1-F_2$ emissions that fall on two local stations operating at 93.9 MHz. and 103.5 MHz. The 20 MHz. trace centered at 98 MHz. shows no evidence of any emissions at all, despite the operation of the two local stations broadcasting from the Willis (Sears) building near by. A wider 100 MHz sweep was conducted (yet not overlaid) and also showed no concern of emissions.



ERI[®] Electronics Research, Inc.

Electronics Research, Inc. 7777 Gardner Rd. Chandler, In 47610 Phone (812) 925-6000 Fax (812) 925-4030 <http://www.eriinc.com/>

Directional Antenna System for WILV, Chicago, Illinois

January 29, 2015

Electronics Research Inc. has provided a custom fabricated directional antenna system that is specially designed to meet the FCC requirements and the general needs of radio station WILV.

The antenna is the ERI model 1083-3CP-DA configuration. The circular polarized system consists of 3 fractional wavelength spaced bays using three driven circular polarized radiating element per bay. The antenna system is orientated to North 322° 31' 59" degrees East. The antenna was tested on a 19 3/4" face tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 100.3 megahertz, which is the center of the FM broadcast channel assigned to WILV.

Pattern measurements were made on a sixty-acre antenna pattern range that is owned and operated by Electronics Research, Inc. The tests were performed under the direction of Thomas B. Silliman, president of Electronics Research, Inc. Mr. Silliman has the Bachelor of Electrical Engineering and the Master of Electrical Engineering degrees from Cornell University and is a registered professional engineer in the states of Indiana, Maryland and Minnesota.

Directional Antenna System For WILV, Chicago, Illinois

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

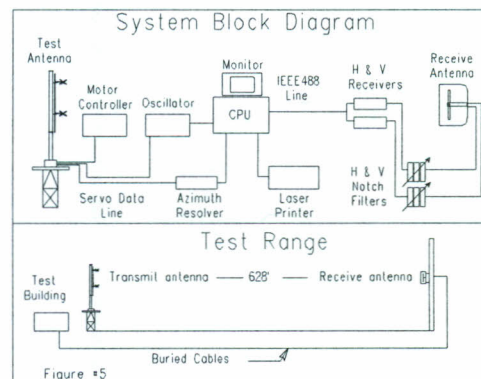
The test antenna consisted of one bay levels of the circular polarized system. The elements and brackets that were used in this test are electrically equivalent to those that are supplied with the antenna. The system was properly grounded during all tests.

The power distribution and phase relationship to the antenna elements was adjusted in order to achieve the directional radiation patterns for both horizontal and vertical polarization components.

The proof-of-performance was accomplished using a 19 3/4" face tower with identical dimension and configuration including all braces, ladders, conduits, coaxial lines and other appurtenances that are included in the actual aperture at which the antenna will be installed. The structure was erected vertically on a turntable mounted on a non-metallic building with the antenna centered vertically on the structure, making the center of radiation of the test approximately 30 feet above ground. The turntable is equipped with a motor drive and azimuth indicating mechanism, resolution of this azimuth measuring device is one-tenth of a degree.

The antenna under test was operated in the transmitting mode and fed from a Wavetek Model 3000 signal generator. The frequency of the signal source was set at 100.3 MHz and was constantly monitored by an Anritsu Model ML521B measuring receiver.

A broad-band horizontal and vertical dipole system, located approximately 628 feet from the test antenna, was used to receive the emitted test signals. The dipole system was mounted at the same height above terrain as the center of the antenna under test. The signals received by the dipole system were fed to the test building by way of two buried Heliax cables to an Anritsu Model ML521B measuring receiver.



Directional Antenna System For WILV, Chicago, Illinois

(Continued)

This data was interfaced to a Hewlett-Packard Laser Jet 4P printer by means of a Pentium computer system. Relative field strength was plotted as a function of azimuth.

The measurements were performed by rotating the test antenna in a counter-clockwise direction and plotting the received signal on polar coordinated graph paper in a clockwise direction. Both horizontal and vertical components were recorded separately.

CONCLUSIONS

The circular polarized system consists of 3 fractional wavelength spaced bays using three driven circular polarized radiating element per bay. The power distribution and phase relationship was fixed when the antenna was manufactured. Proper maintenance of the elements should be all that is required to maintain the pattern in adjustment.

The 1083-3CP-DA array is orientated to North $322^{\circ} 31' 59''$ degrees East on the 19 3/4" face tower. Blue prints provided with the antenna will show the proper antenna orientation alignment. The antenna alignment procedure should be directed by a licensed surveyor as prescribed by the FCC.

Figure #1 represents the measured individual horizontal and vertical components, the composite maximum of either the horizontal or vertical component at any azimuth and the FCC filed envelope pattern. The horizontal plane relative field list for the composite pattern and the individual H & V components are shown as Figure #1 & 1A respectively. The actual measured pattern does not exceed the authorized FCC composite pattern at any azimuth. A calculated vertical plane relative field pattern is shown on Figure #3 attached. The power in the maximum will reach 6.9 kilowatts (8.388 dBk).

The power at North 350 degrees East does not exceed 4.000 kilowatts (6.021 dBk).

The RMS of the vertically polarized horizontal plane component does not exceed the RMS of the horizontally polarized horizontal plane component.

Directional Antenna System
For
WILV, Chicago, Illinois

(Continued)

The composite horizontal and vertical maximum relative field pattern obtained from the measured data as shown on Figure #1 has an RMS that is greater than 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 30 feet 4 in.

The directional antenna should not be mounted on the top of an antenna tower that includes a top-mounted platform larger than the cross-sectional area of the tower in the horizontal plane. No obstructions other than those that are specified by the blue prints supplied with the antenna are to be mounted within 75 ft. horizontally of the system. The vertical distance to the nearest obstruction should be a minimum of 10 ft. from the directional antenna. Metallic guy wires should be a minimum distance of forty feet horizontally from the antenna.

ELECTRONICS RESEARCH, INC.



ERI[®] Horizontal Plane Relative Field Pattern

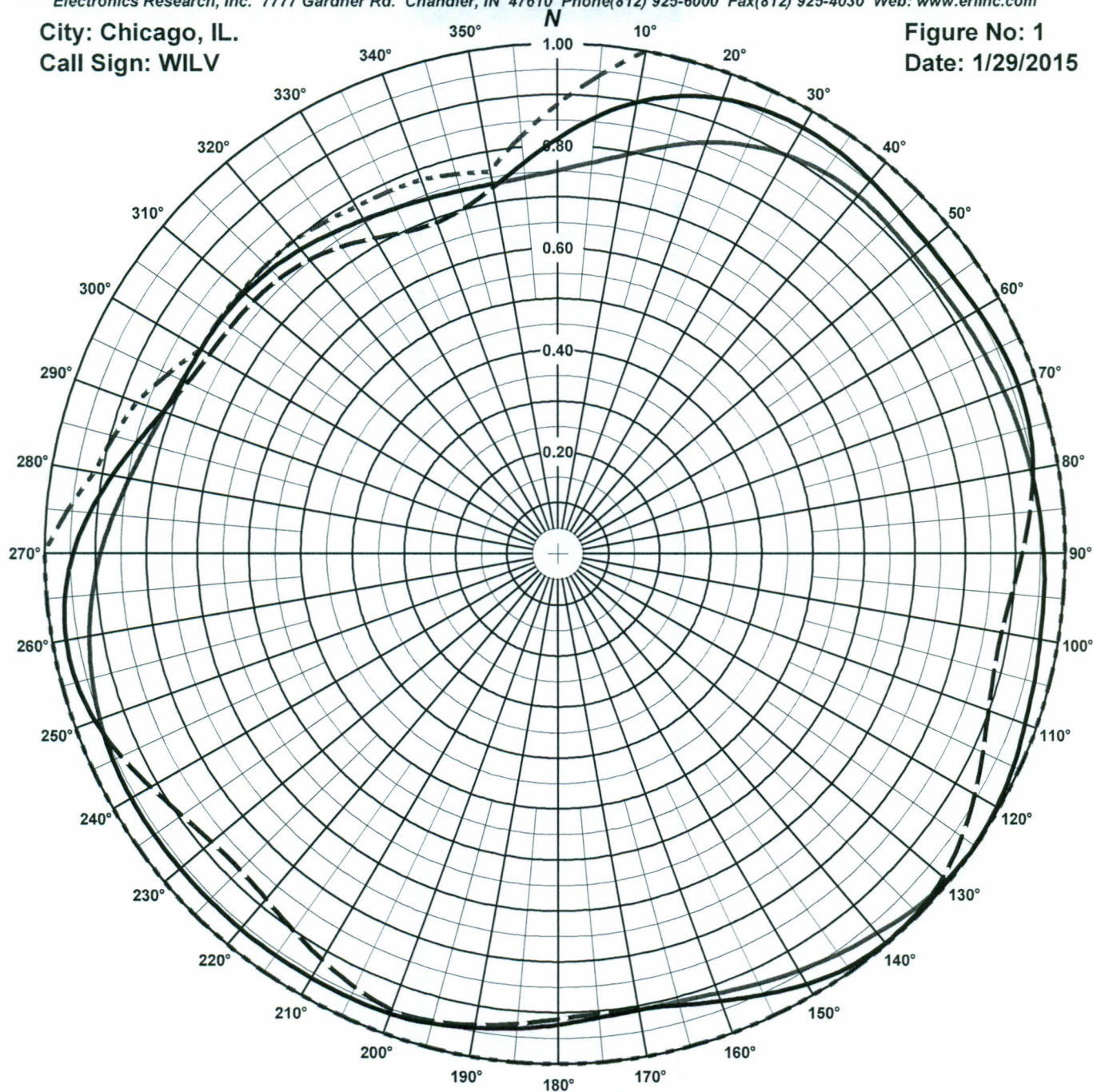
Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

City: Chicago, IL.

Call Sign: WILV

Figure No: 1

Date: 1/29/2015



Antenna Orientation: 322° 31' 59" True

Frequency: 100.3 MHz

Antenna Type: 1083-3CP-DA

Antenna Mounting: Custom

Tower Type: 19 3/4" Tower

HORIZONTAL

RMS: .899

Maximum: 1 @ 126°

Minimum: .736 @ 349°

VERTICAL

RMS: .899

Maximum: .998 @ 138°

Minimum: .691 @ 339°

COMPOSITE

RMS: .918

Maximum: 1 @ 126°

Minimum: .736 @ 349°

FCC ENVELOPE

RMS: .959

Maximum: 1 @ 10°

Minimum: .76 @ 350°

Measured patterns of the horizontal and vertical components, with the composite maximum of either the H or V components and the filed FCC envelope pattern BXPB-20120326AIR.

ERI® Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

Figure# 1

Date: 1/29/2015

Station: WILV

Antenna: 1083-3CP-DA

Location: Chicago, IL.

Antenna Orientation: 322° 31' 59" True

Frequency: 100.3 MHz

Number of Bays: 3

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.813	4.558	6.588	Max H (and or) V	180°	0.924	5.887	7.699	Max H (and or) V
5°	0.858	5.080	7.059	Max H (and or) V	185°	0.934	6.023	7.798	Max H (and or) V
10°	0.898	5.568	7.457	Max H (and or) V	190°	0.944	6.147	7.887	Max H (and or) V
15°	0.928	5.947	7.743	Max H (and or) V	195°	0.953	6.271	7.973	Max H (and or) V
20°	0.948	6.207	7.928	Max H (and or) V	200°	0.960	6.363	8.036	Max H (and or) V
25°	0.959	6.347	8.026	Max H (and or) V	205°	0.961	6.373	8.044	Max H (and or) V
30°	0.963	6.401	8.062	Max H (and or) V	210°	0.961	6.373	8.044	Max H (and or) V
35°	0.961	6.373	8.043	Max H (and or) V	215°	0.961	6.371	8.042	Max H (and or) V
40°	0.954	6.278	7.978	Max H (and or) V	220°	0.960	6.363	8.037	Max H (and or) V
45°	0.947	6.188	7.915	Max H (and or) V	225°	0.960	6.353	8.030	Max H (and or) V
50°	0.944	6.153	7.891	Max H (and or) V	230°	0.960	6.355	8.031	Max H (and or) V
55°	0.946	6.175	7.906	Max H (and or) V	235°	0.960	6.361	8.035	Max H (and or) V
60°	0.952	6.251	7.960	Max H (and or) V	240°	0.959	6.348	8.026	Max H (and or) V
65°	0.959	6.351	8.029	Max H (and or) V	245°	0.956	6.310	8.000	Max H (and or) V
70°	0.964	6.406	8.066	Max H (and or) V	250°	0.959	6.349	8.027	Max H (and or) V
75°	0.961	6.368	8.040	Max H (and or) V	255°	0.971	6.512	8.137	Max H (and or) V
80°	0.950	6.222	7.939	Max H (and or) V	260°	0.973	6.530	8.149	Max H (and or) V
85°	0.951	6.245	7.955	Max H (and or) V	265°	0.963	6.404	8.065	Max H (and or) V
90°	0.957	6.318	8.006	Max H (and or) V	270°	0.943	6.138	7.880	Max H (and or) V
95°	0.961	6.374	8.044	Max H (and or) V	275°	0.914	5.761	7.605	Max H (and or) V
100°	0.964	6.414	8.071	Max H (and or) V	280°	0.879	5.335	7.271	Max H (and or) V
105°	0.970	6.488	8.121	Max H (and or) V	285°	0.845	4.921	6.921	Max H (and or) V
110°	0.976	6.579	8.182	Max H (and or) V	290°	0.815	4.580	6.608	Max H (and or) V
115°	0.987	6.725	8.277	Max H (and or) V	295°	0.804	4.459	6.492	Max H (and or) V
120°	0.995	6.832	8.345	Max H (and or) V	300°	0.800	4.412	6.446	Max H (and or) V
125°	0.998	6.879	8.375	Max H (and or) V	305°	0.798	4.389	6.423	Max H (and or) V
130°	0.996	6.842	8.352	Max H (and or) V	310°	0.794	4.345	6.380	Max H (and or) V
135°	0.996	6.847	8.355	Max H (and or) V	315°	0.787	4.276	6.310	Max H (and or) V
140°	0.997	6.862	8.365	Max H (and or) V	320°	0.778	4.180	6.212	Max H (and or) V
145°	0.991	6.772	8.307	Max H (and or) V	325°	0.767	4.061	6.087	Max H (and or) V
150°	0.975	6.558	8.167	Max H (and or) V	330°	0.756	3.945	5.961	Max H (and or) V
155°	0.954	6.277	7.978	Max H (and or) V	335°	0.747	3.854	5.859	Max H (and or) V
160°	0.934	6.013	7.791	Max H (and or) V	340°	0.741	3.788	5.784	Max H (and or) V
165°	0.917	5.801	7.635	Max H (and or) V	345°	0.737	3.748	5.738	Max H (and or) V
170°	0.909	5.701	7.559	Max H (and or) V	350°	0.736	3.736	5.724	Max H (and or) V
175°	0.914	5.761	7.605	Max H (and or) V	355°	0.768	4.066	6.092	Max H (and or) V

Horizontal Polarization:

Maximum: 1.535 (1.862 dB)

Horizontal Plane: 1.535 (1.862 dB)

Maximum ERP: 6.900 kW

Vertical Polarization:

Maximum: 1.528 (1.842 dB)

Horizontal Plane: 1.528 (1.842 dB)

Maximum ERP: 6.869 kW

Total Input Power: 4.494 kW

Reference: WILV2M.FIG

This list shows the the maximum azimuth values of either the horizontal or vertical components.

ERI® Horizontal Plane Relative Field Pattern

Electronics Research, Inc. 7777 Gardner Rd. Chandler, IN 47610 Phone(812) 925-6000 Fax(812) 925-4030 Web: www.eriinc.com

Figure# 1A

Date: 1/29/2015

Station: WILV

Antenna: 1083-3CP-DA

Location: Chicago, IL.

Antenna Orientation: 322° 31' 59" True

Frequency: 100.3 MHz

Number of Bays: 3

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.751	3.893	5.903	0.813	4.558	6.588	180°	0.924	5.887	7.699	0.913	5.748	7.595
5°	0.769	4.085	6.112	0.858	5.080	7.059	185°	0.934	6.023	7.798	0.925	5.904	7.712
10°	0.795	4.356	6.391	0.898	5.568	7.457	190°	0.944	6.147	7.887	0.938	6.072	7.833
15°	0.826	4.711	6.731	0.928	5.947	7.743	195°	0.953	6.271	7.973	0.948	6.206	7.928
20°	0.858	5.076	7.055	0.948	6.207	7.928	200°	0.960	6.363	8.036	0.951	6.247	7.957
25°	0.883	5.377	7.306	0.959	6.347	8.026	205°	0.961	6.373	8.044	0.938	6.071	7.833
30°	0.901	5.601	7.482	0.963	6.401	8.062	210°	0.961	6.373	8.044	0.920	5.841	7.665
35°	0.912	5.740	7.589	0.961	6.373	8.043	215°	0.961	6.371	8.042	0.901	5.601	7.483
40°	0.916	5.788	7.626	0.954	6.278	7.978	220°	0.960	6.363	8.037	0.884	5.395	7.320
45°	0.913	5.754	7.600	0.947	6.188	7.915	225°	0.960	6.353	8.030	0.875	5.286	7.231
50°	0.910	5.716	7.571	0.944	6.153	7.891	230°	0.960	6.355	8.031	0.879	5.334	7.270
55°	0.912	5.733	7.584	0.946	6.175	7.906	235°	0.960	6.361	8.035	0.894	5.516	7.416
60°	0.917	5.808	7.640	0.952	6.251	7.960	240°	0.959	6.348	8.026	0.915	5.777	7.617
65°	0.924	5.896	7.706	0.959	6.351	8.029	245°	0.956	6.310	8.000	0.939	6.081	7.840
70°	0.932	5.998	7.780	0.964	6.406	8.066	250°	0.949	6.220	7.938	0.959	6.349	8.027
75°	0.939	6.088	7.845	0.961	6.368	8.040	255°	0.940	6.091	7.847	0.971	6.512	8.137
80°	0.945	6.164	7.899	0.950	6.222	7.939	260°	0.926	5.918	7.722	0.973	6.530	8.149
85°	0.951	6.245	7.955	0.932	5.999	7.781	265°	0.910	5.709	7.565	0.963	6.404	8.065
90°	0.957	6.318	8.006	0.914	5.763	7.607	270°	0.890	5.461	7.372	0.943	6.138	7.880
95°	0.961	6.374	8.044	0.897	5.547	7.440	275°	0.867	5.187	7.149	0.914	5.761	7.605
100°	0.964	6.414	8.071	0.886	5.415	7.336	280°	0.845	4.924	6.923	0.879	5.335	7.271
105°	0.970	6.488	8.121	0.887	5.424	7.343	285°	0.827	4.714	6.733	0.845	4.921	6.921
110°	0.976	6.579	8.182	0.899	5.575	7.462	290°	0.813	4.562	6.592	0.815	4.580	6.608
115°	0.987	6.725	8.277	0.920	5.839	7.663	295°	0.804	4.459	6.492	0.793	4.339	6.374
120°	0.995	6.832	8.345	0.944	6.155	7.892	300°	0.800	4.412	6.446	0.780	4.200	6.232
125°	0.998	6.879	8.375	0.967	6.457	8.100	305°	0.798	4.389	6.423	0.774	4.136	6.166
130°	0.996	6.842	8.352	0.986	6.710	8.267	310°	0.794	4.345	6.380	0.770	4.086	6.113
135°	0.986	6.712	8.269	0.996	6.847	8.355	315°	0.787	4.276	6.310	0.763	4.015	6.037
140°	0.971	6.511	8.136	0.997	6.862	8.365	320°	0.778	4.180	6.212	0.752	3.899	5.910
145°	0.958	6.337	8.019	0.991	6.772	8.307	325°	0.767	4.061	6.087	0.735	3.725	5.711
150°	0.945	6.155	7.893	0.975	6.558	8.167	330°	0.756	3.945	5.961	0.715	3.524	5.470
155°	0.930	5.973	7.762	0.954	6.277	7.978	335°	0.747	3.854	5.859	0.697	3.355	5.257
160°	0.917	5.806	7.639	0.934	6.013	7.791	340°	0.741	3.788	5.784	0.691	3.298	5.182
165°	0.909	5.707	7.564	0.917	5.801	7.635	345°	0.737	3.748	5.738	0.702	3.399	5.313
170°	0.909	5.701	7.559	0.906	5.664	7.531	350°	0.736	3.736	5.724	0.728	3.659	5.633
175°	0.914	5.761	7.605	0.905	5.652	7.522	355°	0.740	3.779	5.774	0.768	4.066	6.092

Horizontal Polarization:

Maximum: 1.535 (1.862 dB)

Horizontal Plane: 1.535 (1.862 dB)

Maximum ERP: 6.900 kW

Total Input Power: 4.494 kW

Reference: WILV2M.FIG

Vertical Polarization:

Maximum: 1.528 (1.842 dB)

Horizontal Plane: 1.528 (1.842 dB)

Maximum ERP: 6.869 kW

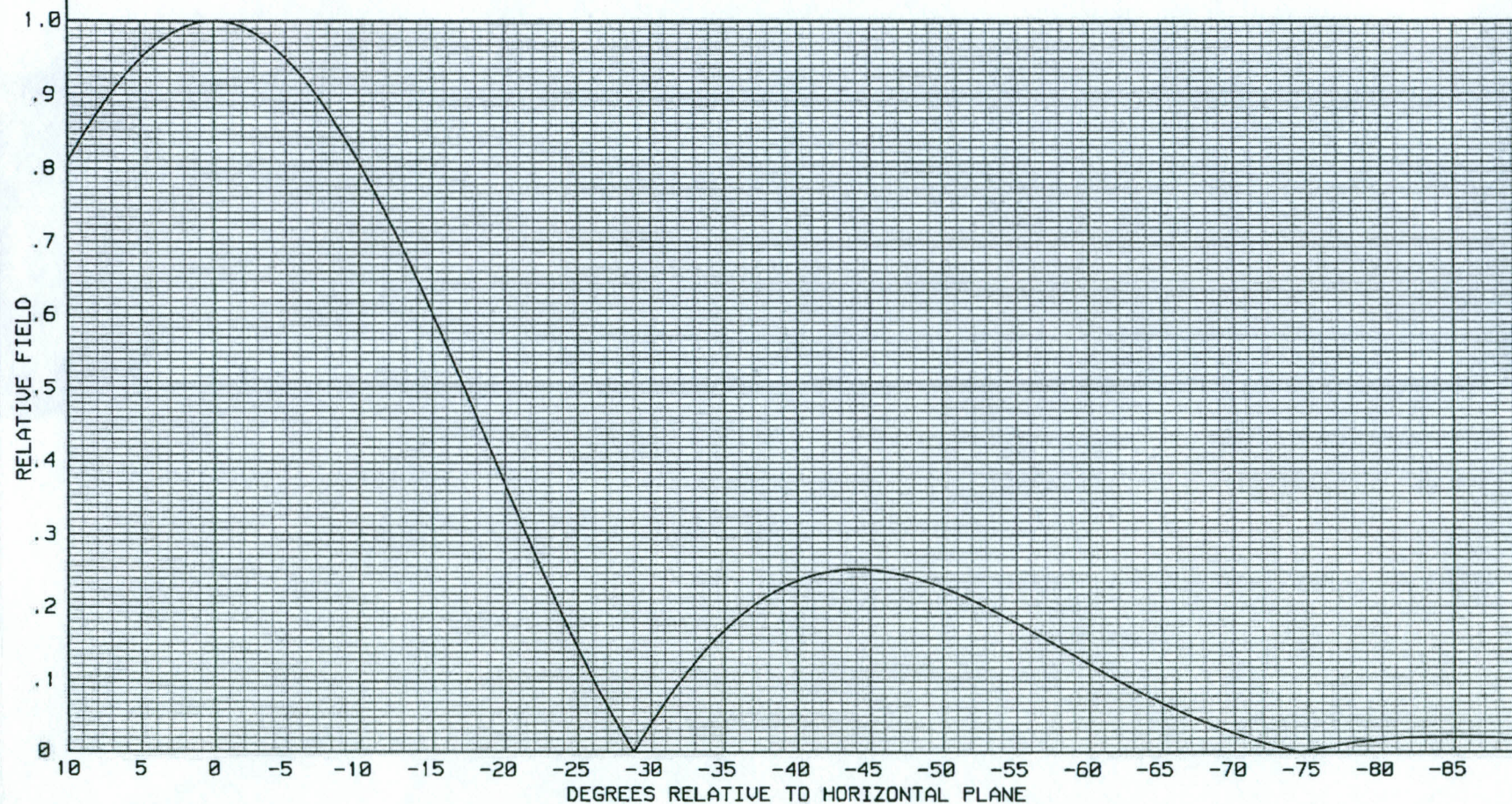
This list shows the azimuth values for the horizontal and vertical components.

ELECTRONICS RESEARCH, INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610

FIGURE 3

-----THEORETICAL-----
VERTICAL PLANE RELATIVE FIELD
3 LEVELS OF TYPE 1080 ELEMENTS
0 DEGREE BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

100.3 MHz.
BAY SPACING:
81.44 INCHES



Directional Antenna System
For
WILV, Chicago, Illinois

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	1083-3CP-DA
Frequency:	100.3 MHz
Number of Bays:	Three

MECHANICAL SPECIFICATIONS

Mounting:	Custom
System length:	20 ft 4in
Bay spacing:	81.44 in
Aperture length required:	30 ft. 4in
Orientation:	322° 31' 59" true
Input flange to the antenna	4 1/16 inch female

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	6.900 kW (8.388 dBk)
Horizontal maximum power gain:	1.535 (1.862 dB)
Maximum vertical ERP:	6.869 kW (8.369 dBk)
Vertical maximum power gain:	1.528 (1.842 dB)
Total input power:	4.494 kW (6.526 dBk)



CHICAGO GUARANTEE SURVEY COMPANY

PROFESSIONAL LAND SURVEYORS

Since 1872

August 21, 2009

Kent Lewin
WDRV
850 N. Michigan Ave. Ste 1510
Chicago, IL 60601

Re: Survey Order #2009-12964 (08-12099)
WDRV Antenna Alignment
200 E. Randolph St. (AON Building)
Chicago, IL

Dear Mr. Lewin,

Per our field measurement at the above referenced site on July 27, 2009, we observed the azimuth orientation of the antenna at 322° 31' 59" from true North.

Sincerely,

Brian S. Stout, PLS
Chicago Guarantee Survey Company



Directional Antenna Installation Certification

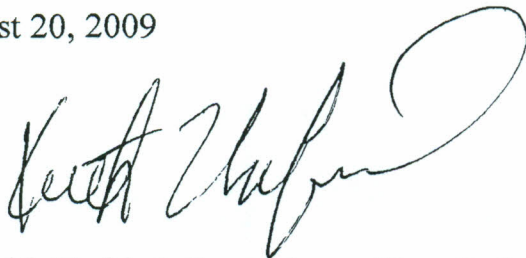
In compliance with the FCC Regulation 73.316(c)(2)(vii), this is to certify that the ERI model 1083-3CP-DA directional antenna for Bonneville International Corporation (WDRV Radio) operating at 97.1 MHz and licensed to Chicago, IL has been erected according to design and installation instructions provided by Electronics Research, Incorporated (ERI) of Chandler, IN.

This document is separate from the licensed surveyor's certification of the antenna's orientation.

The installation was supervised by Mr. Keith Unfried, of ERI. I have been employed by ERI since 1996 and have served in the capacity of Installations Manager for over (8) years. I have performed and supervised numerous installations.

Date: August 20, 2009

Signature:

A handwritten signature in black ink, appearing to read 'Keith Unfried', with a large, stylized loop at the end.

(Keith Unfried, Supervisor of Installations Manager)