ELECTRONICS RESEARCH, INC. ERI®

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 WBGO, Newark, New Jersey

June 10, 2011

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

The antenna is the ERI model 1182-1CP-DA configuration. The circular polarized system consists of one bay using two driven circular polarized radiating element, one horizontal parasitic element placed one quarter wave above and below the bay and one vertical parasitic element at bay level. The antenna was mounted on the North 254 degrees East tower face with bracketry to provide an antenna orientation of North 248 degrees East. The antenna was tested on an 8' face square tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 88.3 megahertz, which is the center of the FM broadcast channel assigned to WBGO.

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
Proposed For
WBGO, Newark, New Jersey

(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of a full-scale model of the complete circular polarized system with the associated horizontal and vertical parasitic elements. The elements and brackets that were used in this test are electrically equivalent to those that will be supplied with the antenna

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 8' face square 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 a US Digital angle position indicator. The resolution of this angle position indicator is one-hundredth of a degree.

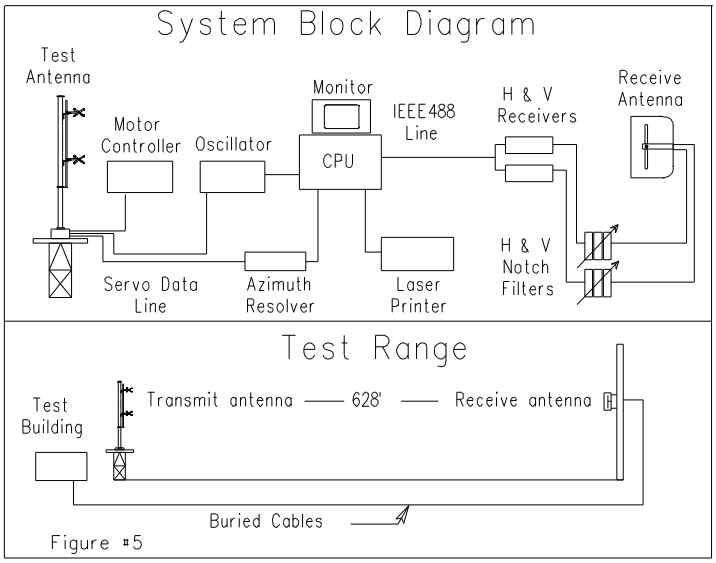

Figure #5

The antenna under test was operated in the transmitting mode and fed from a HP8657D signal generator. The frequency of the signal source was set at 88.3 MHz and was constantly monitored by a Rohde & Schwarz ESVD measuring receiver.

(Continued)

A broadband 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 a Rohde & Schwarz measuring receiver. This data was interfaced to a laser jet printer by means of a 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 co-ordinated graph paper in a clockwise direction. Both horizontal and vertical components were recorded separately.

CONCLUSIONS

The circular polarized system consists of one bay using two driven circular polarized radiating element, one horizontal parasitic element placed one quarter wave above and below the bay and one vertical parasitic element at bat level. The power distribution and phase relationship will be fixed when antenna is manufactured. Proper maintenance of the elements should be all that is required to maintain the pattern in adjustment.

The 1182-1CP-DA array is to be mounted on the North 254 degrees East tower face of the 8' face square tower at a bearing of North 248 degrees East. 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 2.500 kilowatts (3.979 dBk).

Directional Antenna System
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(Continued)

The power at North 70 degrees East does not exceed 0.216 kilowatts (-6.655 dBk).

The power at North 180 degrees East does not exceed 1.336 kilowatts (1.258 dBk).

The power at North 300 degrees East does not exceed 1.146 kilowatts (0.592 dBk).

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

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 that 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 20 feet.

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

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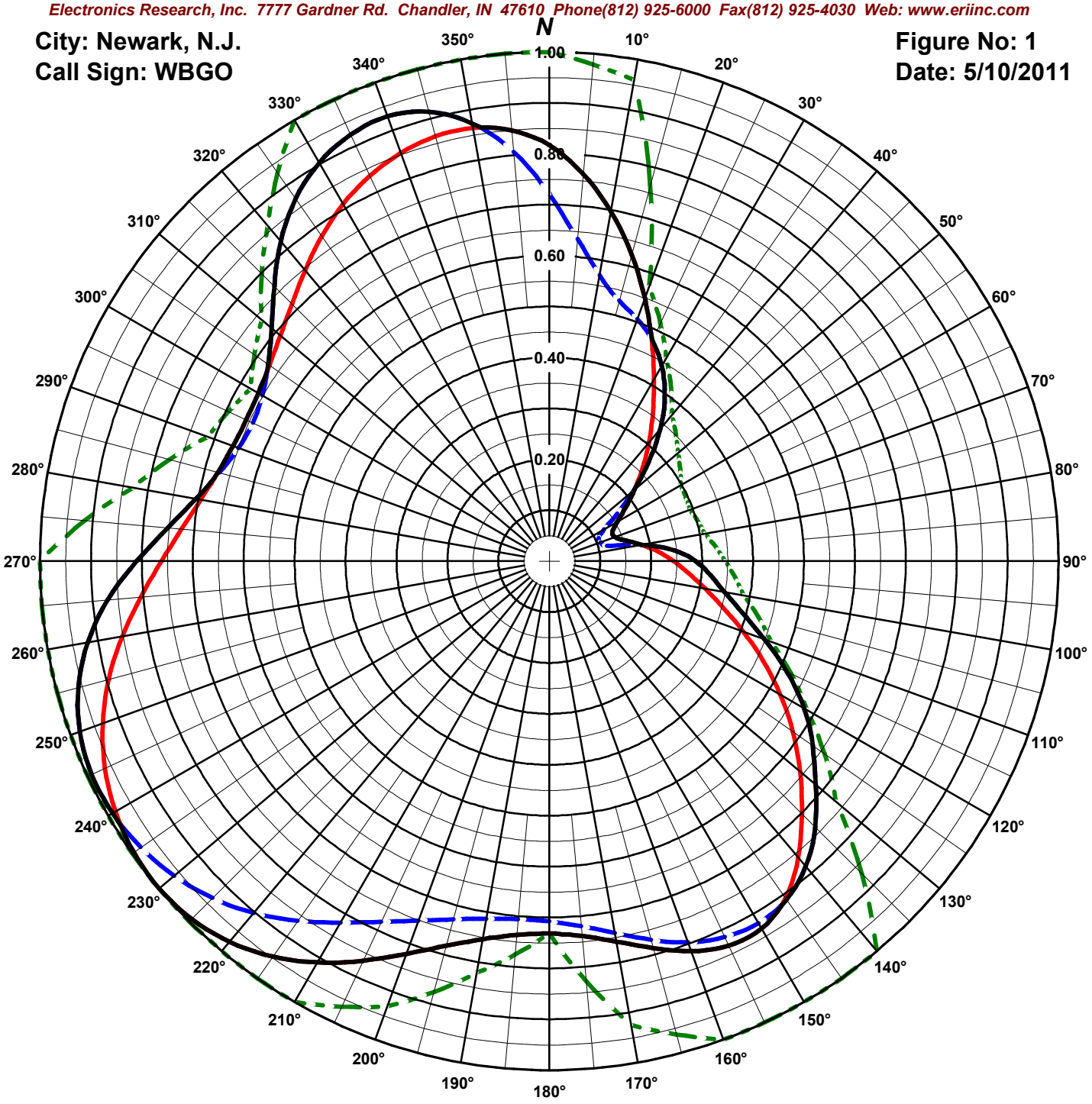
City: Newark, N.J.
Call Sign: WBGO

Figure No: 1
Date: 5/10/2011



Antenna Orientation: 248° True

Frequency: 88.3 MHz
Antenna Type: 1182-1CP-DA

Antenna Mounting: Custom
Tower Type: 8' face Tower

HORIZONTAL	VERTICAL	COMPOSITE	FCC ENVELOPE
RMS: .699	RMS: .699	RMS: .72	RMS: .802
Maximum: 1 @ 231°	Maximum: .992 @ 243°	Maximum: 1 @ 231°	Maximum: 1 @ 0°
Minimum: .135 @ 67°	Minimum: .106 @ 67°	Minimum: .135 @ 67°	Minimum: .294 @ 70°

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

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: 5/10/2011**
Station: WBGO **Antenna: 1182-1CP-DA**
Location: Newark, N.J. **Antenna Orientation: 248° True**
Frequency: 88.3 MHz **Number of Bays: 1**

Azimuth	Envelope			Polarization	Azimuth	Envelope			Polarization
	Field	kW	dBk	Maximum		Field	kW	dBk	Maximum
0°	0.817	1.670	2.228	Horizontal	180°	0.731	1.336	1.257	Horizontal
5°	0.763	1.456	1.633	Horizontal	185°	0.737	1.358	1.328	Horizontal
10°	0.697	1.216	0.848	Horizontal	190°	0.754	1.421	1.527	Horizontal
15°	0.624	0.974	-0.112	Horizontal	195°	0.782	1.530	1.846	Horizontal
20°	0.549	0.753	-1.232	Horizontal	200°	0.821	1.684	2.264	Horizontal
25°	0.478	0.572	-2.424	Vertical	205°	0.866	1.875	2.729	Horizontal
30°	0.442	0.489	-3.110	Vertical	210°	0.910	2.072	3.164	Horizontal
35°	0.396	0.391	-4.075	Vertical	215°	0.948	2.248	3.517	Horizontal
40°	0.339	0.287	-5.418	Vertical	220°	0.976	2.382	3.770	Horizontal
45°	0.277	0.192	-7.176	Vertical	225°	0.993	2.467	3.923	Horizontal
50°	0.218	0.119	-9.235	Horizontal	230°	1.000	2.500	3.979	Horizontal
55°	0.183	0.083	-10.784	Horizontal	235°	0.996	2.482	3.948	Horizontal
60°	0.154	0.060	-12.254	Horizontal	240°	0.990	2.451	3.894	Vertical
65°	0.137	0.047	-13.289	Horizontal	245°	0.992	2.458	3.906	Vertical
70°	0.137	0.047	-13.261	Horizontal	250°	0.981	2.405	3.812	Vertical
75°	0.156	0.061	-12.180	Horizontal	255°	0.957	2.290	3.599	Vertical
80°	0.184	0.085	-10.730	Horizontal	260°	0.920	2.117	3.257	Vertical
85°	0.246	0.152	-8.196	Vertical	265°	0.870	1.892	2.770	Vertical
90°	0.287	0.206	-6.855	Vertical	270°	0.810	1.640	2.148	Vertical
95°	0.318	0.253	-5.976	Vertical	275°	0.752	1.414	1.503	Vertical
100°	0.349	0.305	-5.155	Vertical	280°	0.705	1.242	0.941	Vertical
105°	0.393	0.386	-4.136	Vertical	285°	0.674	1.135	0.551	Horizontal
110°	0.450	0.505	-2.963	Vertical	290°	0.661	1.092	0.382	Horizontal
115°	0.515	0.664	-1.778	Vertical	295°	0.656	1.077	0.321	Horizontal
120°	0.578	0.835	-0.784	Vertical	300°	0.660	1.088	0.367	Horizontal
125°	0.631	0.997	-0.015	Vertical	305°	0.674	1.135	0.550	Vertical
130°	0.683	1.167	0.669	Vertical	310°	0.712	1.266	1.025	Vertical
135°	0.738	1.363	1.344	Vertical	315°	0.763	1.457	1.635	Vertical
140°	0.783	1.534	1.858	Vertical	320°	0.820	1.682	2.257	Vertical
145°	0.812	1.647	2.166	Vertical	325°	0.868	1.886	2.755	Vertical
150°	0.833	1.736	2.397	Horizontal	330°	0.903	2.040	3.096	Vertical
155°	0.834	1.737	2.398	Horizontal	335°	0.924	2.134	3.291	Vertical
160°	0.815	1.661	2.205	Horizontal	340°	0.930	2.160	3.345	Vertical
165°	0.787	1.548	1.897	Horizontal	345°	0.914	2.088	3.197	Vertical
170°	0.759	1.439	1.582	Horizontal	350°	0.873	1.906	2.801	Vertical
175°	0.739	1.366	1.355	Horizontal	355°	0.849	1.803	2.560	Horizontal

Horizontal Polarization:
Maximum: 0.897 (-0.473 dB)
Horizontal Plane: 0.897 (-0.473 dB)
Maximum ERP: 2.500 kW

Vertical Polarization:
Maximum: 0.883 (-0.540 dB)
Horizontal Plane: 0.883 (-0.540 dB)
Maximum ERP: 2.462 kW

Total Input Power: 2.788 kW
Reference: WBGO1M.FIG

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

ERI® Horizontal Plane Relative Field Pattern

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Figure# 1A **Date: 5/10/2011**
Station: WBGO **Antenna: 1182-1CP-DA**
Location: Newark, N.J. **Antenna Orientation: 248° True**
Frequency: 88.3 MHz **Number of Bays: 1**

Azimuth	Horizontal			Vertical			Azimuth	Horizontal			Vertical		
	Field	kW	dBk	Field	kW	dBk		Field	kW	dBk	Field	kW	dBk
0°	0.817	1.670	2.228	0.721	1.299	1.137	180°	0.731	1.336	1.257	0.708	1.252	0.977
5°	0.763	1.456	1.633	0.635	1.009	0.039	185°	0.737	1.358	1.328	0.706	1.246	0.956
10°	0.697	1.216	0.848	0.570	0.812	-0.903	190°	0.754	1.421	1.527	0.713	1.272	1.044
15°	0.624	0.974	-0.112	0.529	0.701	-1.546	195°	0.782	1.530	1.846	0.728	1.327	1.227
20°	0.549	0.753	-1.232	0.506	0.639	-1.945	200°	0.821	1.684	2.264	0.751	1.411	1.495
25°	0.476	0.567	-2.463	0.478	0.572	-2.424	205°	0.866	1.875	2.729	0.782	1.527	1.840
30°	0.411	0.423	-3.741	0.442	0.489	-3.110	210°	0.910	2.072	3.164	0.820	1.679	2.252
35°	0.354	0.314	-5.030	0.396	0.391	-4.075	215°	0.948	2.248	3.517	0.862	1.859	2.692
40°	0.305	0.232	-6.349	0.339	0.287	-5.418	220°	0.976	2.382	3.770	0.902	2.035	3.085
45°	0.259	0.168	-7.742	0.277	0.192	-7.176	225°	0.993	2.467	3.923	0.936	2.188	3.401
50°	0.218	0.119	-9.235	0.217	0.117	-9.309	230°	1.000	2.500	3.979	0.961	2.311	3.637
55°	0.183	0.083	-10.784	0.163	0.066	-11.790	235°	0.996	2.482	3.948	0.980	2.399	3.801
60°	0.154	0.060	-12.254	0.124	0.039	-14.126	240°	0.984	2.419	3.836	0.990	2.451	3.894
65°	0.137	0.047	-13.289	0.107	0.029	-15.436	245°	0.962	2.316	3.647	0.992	2.458	3.906
70°	0.137	0.047	-13.261	0.107	0.029	-15.432	250°	0.933	2.177	3.378	0.981	2.405	3.812
75°	0.156	0.061	-12.180	0.117	0.034	-14.672	255°	0.896	2.005	3.022	0.957	2.290	3.599
80°	0.184	0.085	-10.730	0.183	0.083	-10.789	260°	0.851	1.812	2.582	0.920	2.117	3.257
85°	0.214	0.115	-9.397	0.246	0.152	-8.196	265°	0.805	1.620	2.094	0.870	1.892	2.770
90°	0.244	0.149	-8.264	0.287	0.206	-6.855	270°	0.761	1.449	1.612	0.810	1.640	2.148
95°	0.275	0.189	-7.229	0.318	0.253	-5.976	275°	0.724	1.312	1.178	0.752	1.414	1.503
100°	0.311	0.241	-6.174	0.349	0.305	-5.155	280°	0.695	1.208	0.820	0.705	1.242	0.941
105°	0.354	0.313	-5.039	0.393	0.386	-4.136	285°	0.674	1.135	0.551	0.670	1.124	0.507
110°	0.406	0.412	-3.856	0.450	0.505	-2.963	290°	0.661	1.092	0.382	0.649	1.054	0.229
115°	0.463	0.536	-2.706	0.515	0.664	-1.778	295°	0.656	1.077	0.321	0.642	1.031	0.135
120°	0.523	0.684	-1.649	0.578	0.835	-0.784	300°	0.660	1.088	0.367	0.651	1.058	0.246
125°	0.583	0.851	-0.700	0.631	0.997	-0.015	305°	0.671	1.125	0.512	0.674	1.135	0.550
130°	0.643	1.033	0.141	0.683	1.167	0.669	310°	0.689	1.187	0.746	0.712	1.266	1.025
135°	0.702	1.230	0.900	0.738	1.363	1.344	315°	0.715	1.276	1.060	0.763	1.457	1.635
140°	0.760	1.445	1.599	0.783	1.534	1.858	320°	0.746	1.390	1.431	0.820	1.682	2.257
145°	0.809	1.635	2.134	0.812	1.647	2.166	325°	0.779	1.517	1.810	0.868	1.886	2.755
150°	0.833	1.736	2.397	0.821	1.686	2.268	330°	0.810	1.639	2.145	0.903	2.040	3.096
155°	0.834	1.737	2.398	0.815	1.660	2.201	335°	0.835	1.741	2.409	0.924	2.134	3.291
160°	0.815	1.661	2.205	0.797	1.588	2.008	340°	0.853	1.819	2.597	0.930	2.160	3.345
165°	0.787	1.548	1.897	0.770	1.482	1.707	345°	0.864	1.864	2.706	0.914	2.088	3.197
170°	0.759	1.439	1.582	0.741	1.374	1.379	350°	0.864	1.865	2.707	0.873	1.906	2.801
175°	0.739	1.366	1.355	0.720	1.295	1.122	355°	0.849	1.803	2.560	0.807	1.628	2.117

Horizontal Polarization:
Maximum: 0.897 (-0.473 dB)
Horizontal Plane: 0.897 (-0.473 dB)
Maximum ERP: 2.500 kW

Vertical Polarization:
Maximum: 0.883 (-0.540 dB)
Horizontal Plane: 0.883 (-0.540 dB)
Maximum ERP: 2.462 kW

Total Input Power: 2.788 kW
Reference: WBGO1M.FIG

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

ERI® Vertical Plane Relative Field Pattern

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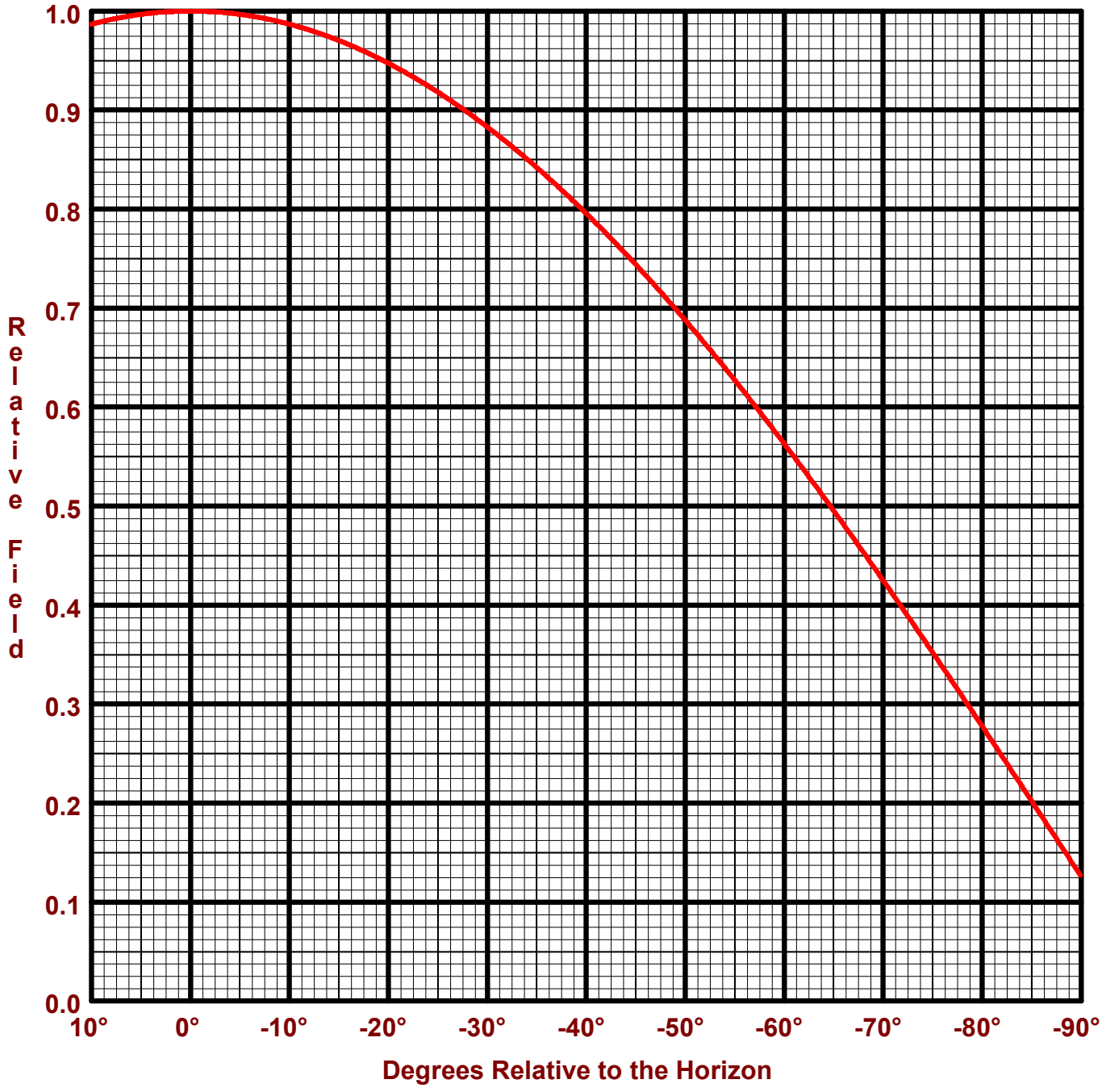
Figure No: 3
Call Sign: WBGO
Location: Newark, N.J.
Frequency: 88.3 MHz
1 bay 1182-1CP-DA antenna

Date: 5/10/2011
1 Wave-length Spacing
0° Beam Tilt
0% First Null Fill



Horizontal Polarization:
Maximum: 0.897 (-0.473 dB)
Horizontal Plane: 0.897 (-0.473 dB)
Maximum ERP: 2.500 kW

Vertical Polarization:
Maximum: 0.883 (-0.540 dB)
Horizontal Plane: 0.883 (-0.540 dB)
Maximum ERP: 2.462 kW

Directional Antenna System
for
WBGO, Newark, New Jersey

(Continued)

ANTENNA SPECIFICATIONS

Antenna Type:	1182-1CP-DA
Frequency:	88.3 MHz
Number of Bays:	One

MECHANICAL SPECIFICATIONS

Mounting:	Standard
System length:	10 ft
Aperture length required:	20 ft
Orientation:	248° true

Input flange to the antenna 1 5/8” female.

ELECTRICAL SPECIFICATIONS
(For directional use)

Maximum horizontal ERP:	2.500 kW (3.979 dBk)
Horizontal maximum power gain:	0.897 (-0.473 dB)
Maximum vertical ERP:	2.462 kW (3.913 dBk)
Vertical maximum power gain:	0.883 (-0.540 dB)
Total input power:	2.788 kW (4.452 dBk)