

JULY 18, 1989

CIRCULAR POLARIZED DIRECTIONAL ANTENNA SYSTEM
FOR RADIO STATIONS KPLU, KLSY, KMPS AND KRPM
WITH TRANSMITTING AND ANTENNA FACILITIES
LOCATED AT WEST TIGER MOUNTAIN, WASHINGTON

Electronics Research, Inc. is providing a custom fabricated directional antenna system that is specially designed to meet the F.C.C. requirements and the general needs of radio stations KPLU, KLSY, KMPS and KRPM.

The antenna is the 1082-4CP-DA type configuration. The circular polarized system consists of four 10' vertically spaced bays using 2 individually excited iris cells per bay. The antenna was tested on a full scale model of a section of a self supporting Magnum tower that exists at the West Tiger Mountain site. This is the structure planned to support the array. This model contained all ladders, transmission lines and other devices that will be in the aperture of the proposed antenna system. All tests were performed on frequencies of 88.5 MHz, 92.5 MHz, 94.1 Mhz and 106.1 MHz which are the centers of the FM broadcast channels assigned to the above stations. In anticipation of possible expanded use of the antenna additional pattern measurements were made on other FM channels which are allotted to the general Seattle-Tacoma area.

Pattern measurements were made on a fifty-acre antenna pattern range which 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 both the Bachelor of Electrical Engineering and the Master of Electrical Engineering degrees from Cornell University, and is also a registered professional engineer in the states of Indiana, Maryland and Minnesota.

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of the complete four bay circular polarized system. The elements and brackets that were used in this test are the ones that will be installed at the West Tiger Mountain site.

The tower 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 system is one-tenth of a degree.

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(Continued)

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 each of the carrier frequencies of the involved stations.

A broad-band horizontal and vertical dipole system, located approximately 628 feet from the test antenna, and mounted at the same height above terrain as the center of the antenna under test, was used to receive the emitted test signals. The signals received by the dipole system were fed to the test building by way of two buried Heliac cables to an Anritsu Model ML521B measuring receiver. This data was interfaced to a Hewlett-Packard Model 9872C plotter by means of a Hewlett-Packard Model 86 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. The patterns furnished herewith are the averages of multiple separate measurements performed on each of the frequencies indicated.



Dan Dowdle, Test Site Director
Electronics Research, Inc.
108 Market Street
Newburgh, Indiana 47630

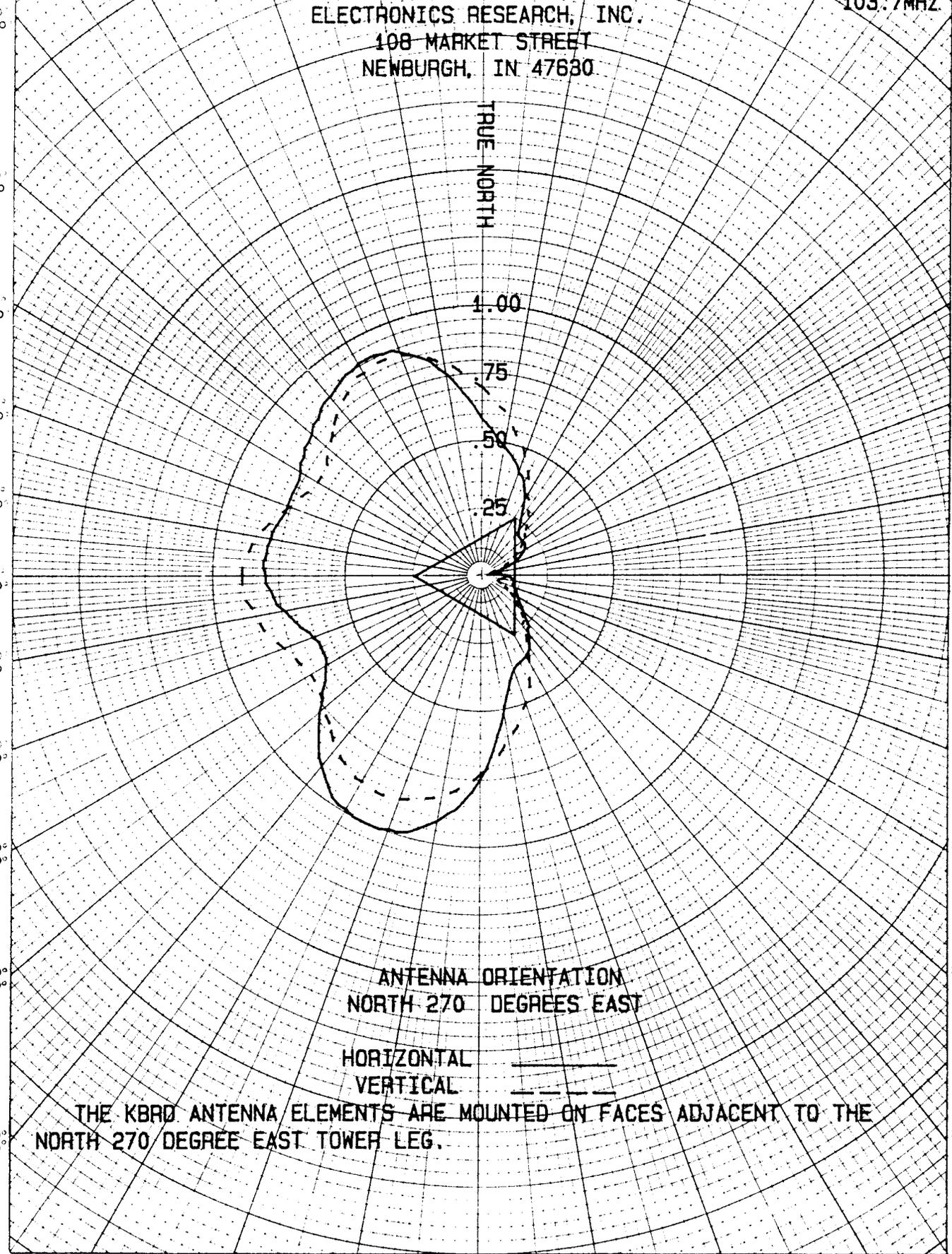
FIGURE # 1
1082-4CP-DA ANTENNA
TAPERED TOWER

HORIZONTAL PLANE RELATIVE FIELD PATTERN

JUNE 30, 1989
STATION KBRD
TACOMA, WA
103.7MHZ

ELECTRONICS RESEARCH, INC.
108 MARKET STREET
NEWBURGH, IN 47680

TRUE NORTH



ANTENNA ORIENTATION
NORTH 270 DEGREES EAST

HORIZONTAL ———
VERTICAL - - - - -

THE KBRD ANTENNA ELEMENTS ARE MOUNTED ON FACES ADJACENT TO THE
NORTH 270 DEGREE EAST TOWER LEG.

DIETZGEN CORPORATION
MADE IN U.S.A.

NO. 341-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

30' 20' 10' 350' 340' 330' 330' 20' 30'

150° 160° 170° 180° 190° 200° 210° 210° 170° 160° 150°

40 320
50 310
60 300
70 290
80 280
90 270
100 260
110 250
120 240
130 230
140 220

320° 40°
310° 50°
300° 60°
290° 70°
280° 80°
270° 90°
260° 100°
250° 110°
240° 120°
230° 130°
220° 140°

JUNE 30 1989
 HORIZONTAL PLANE RELATIVE FIELD & DBK LIST
 FOR RADIO STATION KBRD 103.7MHz

AZIMUTH	H POL RELATIVE FIELD	H POL DBK	H POL POWER KW	V POL RELATIVE FIELD	V POL DBK	V POL POWER KW	AZIMUTH	H POL RELATIVE FIELD	H POL DBK	H POL POWER KW	V POL RELATIVE FIELD	V POL DBK	V POL POWER KW
0.0	.582	12.93	19.65	.700	14.54	28.46	180.0	.741	15.03	31.87	.725	14.84	30.49
5.0	.531	12.14	16.36	.643	13.79	23.95	185.0	.842	16.14	41.08	.773	15.39	34.62
10.0	.490	11.43	13.91	.589	13.04	20.15	190.0	.912	16.83	48.24	.814	15.84	38.39
15.0	.455	10.79	11.98	.528	12.09	16.19	195.0	.966	17.33	54.14	.847	16.19	41.61
20.0	.407	9.83	9.63	.474	11.14	13.01	200.0	.989	17.53	56.68	.872	16.44	44.08
25.0	.378	9.19	8.29	.415	10.00	9.99	205.0	1.000	17.63	58.00	.882	16.54	45.10
30.0	.320	7.73	5.94	.343	8.34	6.83	210.0	.989	17.53	56.68	.872	16.44	44.08
35.0	.257	5.84	3.84	.309	7.45	5.56	215.0	.966	17.33	54.14	.857	16.29	42.58
40.0	.216	4.33	2.71	.269	6.24	4.21	220.0	.912	16.83	48.24	.823	15.94	39.26
45.0	.202	3.73	2.36	.233	5.00	3.16	225.0	.846	16.19	41.55	.786	15.54	35.83
50.0	.202	3.73	2.36	.207	3.94	2.48	230.0	.776	15.43	34.95	.751	15.14	32.67
55.0	.200	3.63	2.31	.176	2.55	1.80	235.0	.708	14.64	29.08	.729	14.89	30.85
60.0	.182	2.83	1.92	.143	.74	1.19	240.0	.661	14.03	25.32	.725	14.84	30.49
65.0	.152	1.20	1.35	.103	-2.08	.62	245.0	.646	13.83	24.18	.746	15.09	32.30
70.0	.110	-1.57	.70	.053	-7.86	.16	250.0	.661	14.03	25.32	.777	15.44	35.01
75.0	.081	-6.67	.22	.028	-13.56	.04	255.0	.700	14.53	28.41	.823	15.94	39.29
80.0	.023	-15.27	.03	.053	-7.86	.16	260.0	.741	15.03	31.87	.852	16.24	42.09
85.0	.058	-7.08	.20	.080	-4.30	.37	265.0	.781	15.48	35.35	.882	16.54	45.10
90.0	.097	-2.67	.54	.090	-3.26	.47	270.0	.804	15.73	37.45	.892	16.64	46.15
95.0	.115	-1.16	.76	.086	-3.66	.43	275.0	.808	15.78	37.86	.877	16.49	44.59
100.0	.124	-.47	.90	.073	-5.06	.31	280.0	.794	15.63	36.60	.852	16.24	42.09
105.0	.123	-.57	.88	.065	-6.06	.25	285.0	.781	15.48	35.35	.804	15.74	37.52
110.0	.132	.03	1.01	.078	-4.56	.35	290.0	.767	15.33	34.15	.759	15.24	33.44
115.0	.145	.89	1.23	.104	-2.05	.62	295.0	.767	15.33	34.15	.725	14.84	30.50
120.0	.158	1.63	1.46	.129	-.16	.96	300.0	.776	15.43	34.95	.700	14.54	28.46
125.0	.177	2.59	1.61	.159	1.65	1.46	305.0	.804	15.73	37.45	.789	14.64	29.12
130.0	.207	3.93	2.47	.191	3.24	2.11	310.0	.822	15.93	39.21	.733	14.94	31.20
135.0	.250	5.59	3.62	.225	4.70	2.95	315.0	.851	16.23	42.02	.777	15.44	35.02
140.0	.279	6.53	4.50	.254	5.74	3.75	320.0	.871	16.43	44.00	.814	15.84	38.39
145.0	.316	7.64	5.80	.308	7.40	5.49	325.0	.896	16.68	46.61	.847	16.19	41.61
150.0	.339	8.23	6.66	.363	8.84	7.66	330.0	.912	16.83	48.24	.872	16.44	44.08
155.0	.349	8.48	7.05	.432	10.35	10.83	335.0	.907	16.78	47.69	.882	16.54	45.10
160.0	.363	8.83	7.65	.496	11.54	14.26	340.0	.881	16.53	45.02	.872	16.44	44.08
165.0	.412	9.94	9.86	.557	12.54	17.97	345.0	.832	16.03	40.13	.842	16.14	41.14
170.0	.501	11.63	14.57	.610	13.34	21.59	350.0	.759	15.23	33.38	.795	15.64	36.66
175.0	.617	13.44	22.10	.673	14.19	26.26	355.0	.669	14.14	25.92	.751	15.14	32.68

CITY OF LICENSE: TACOMA, WASHINGTON
 MOUNTING STRUCTURE: MAGNUM TOWER-TIGER MT SITE
 ANTENNA TYPE: 1082-4CP-DA NUMBER OF BAYS:4
 HORIZONTAL MAXIMUM RELATIVE FIELD= 1 AZIMUTH 202
 HORIZONTAL MINIMUM RELATIVE FIELD= 2.26464430759E-2 AZIMUTH 80
 VERTICAL MAXIMUM RELATIVE FIELD= .892047369557 AZIMUTH 268
 VERTICAL MINIMUM RELATIVE FIELD= 2.69393998837E-2 AZIMUTH 74
 HORIZONTAL R.M.S.=.62366 VERTICAL R.M.S.=.62366
 MAXIMUM HORIZONTAL E.R.F.= 58.0000KW MAXIMUM VERTICAL E.R.F.= 46.1534KW
 ANTENNA ORIENTATION: NORTH 270 DEGREES EAST

ELECTRONICS RESEARCH, INC.
100 MARKET STREET
NEWBURGH, IN. 47630
(812) 853-9318

-----THEORETICAL-----
VERTICAL PLANE RELATIVE FIELD
4 TYPE 1000 ELEMENTS UNIFORMLY SPACED
120.00 INCHES CENTER TO CENTER VERTICALLY
-.94 DEGREE(S) BERM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

FIGURE 2
JUNE 11, 1991
COMPUTED FOR
103.70 MHz

