ORIGINAL

Print Form

Federal Communications Commission
Washington, D. C. 20554

Approved by OMB
3060-0627
Expires 01/31/98

FOR FCC USE ONLY

FCC 302-AM
APPLICATION FOR AM BROADCAST STATION LICENSE

(Please read instructions before filling out form.)

FOR COMMISSION USE ONLY
FILE NO. BAML-20091118AGZ

SECTION I - APPLICANT FEE INFORMATION

1. PAYOR NAME (Last, First, Middle Initial)
CBS Corporation

MAILING ADDRESS (Line 1) (Maximum 35 characters)
2175 K Street NW

MAILING ADDRESS (Line 2) (Maximum 35 characters)
Suite 350

CITY	STATE OR COUNTRY (if foreign address)	ZIP CODE
Washington	DC	20037

TELEPHONE NUMBER (include area code)	CALL LETTERS	OTHER FCC IDENTIFIER (If applicable)
202-457-4505	KRAK	72716

2. A. Is a fee submitted with this application? Yes [X] No [ ]

B. If No, indicate reason for fee exemption (see 47 C.F.R. Section 20050801BAG

[ ] Governmental Entity [ ] Noncommercial educational licensee [ ] Other (Please explain):

C. If Yes, provide the following information: 0003616586

Enter in Column (A) the correct Fee Type Code for the service you are applying for. Fee Type Codes may be found in the "Mass Media Services Fee Filing Guide." Column (B) lists the Fee Multiple applicable for this application. Enter fee amount due in Column (C).

(A) FEE TYPE CODE	(B) FEE MULTIPLE	(C) FEE DUE FOR FEE TYPE CODE IN COLUMN (A)	FOR FCC USE ONLY
MMR	0001	$ 615	

To be used only when you are requesting concurrent actions which result in a requirement to list more than one Fee Type Code.

(A)	(B)	(C)	FOR FCC USE ONLY
MOR	0001	$ 705	

ADD ALL AMOUNTS SHOWN IN COLUMN C, AND ENTER THE TOTAL HERE. THIS AMOUNT SHOULD EQUAL YOUR ENCLOSED REMITTANCE.

TOTAL AMOUNT REMITTED WITH THIS APPLICATION	FOR FCC USE ONLY
$ 1,320	

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT CBS Radio Stations Inc.		
MAILING ADDRESS 2175 K Street NW., Suite 350		
CITY Washington	STATE DC	ZIP CODE 20037

2. This application is for:

☐ Commercial ☐ Noncommercial

☐ AM Directional ☐ AM Non-Directional

Call letters	Community of License	Construction Permit File No.	Modification of Construction Permit File No(s).	Expiration Date of Last Construction Permit
KRAK 72716	Hesperia			

3. Is the station now operating pursuant to automatic program test authority in accordance with 47 C.F.R. Section 73.1620?

☒ Yes ☐ No

If No, explain in an Exhibit.

Exhibit No.

4. Have all the terms, conditions, and obligations set forth in the above described construction permit been fully met?

☐ Yes ☐ No

If No, state exceptions in an Exhibit.

Exhibit No.

5. Apart from the changes already reported, has any cause or circumstance arisen since the grant of the underlying construction permit which would result in any statement or representation contained in the construction permit application to be now incorrect? If Yes, explain in an Exhibit.

☐ Yes ☐ No

Exhibit No.

6. Has the permittee filed its Ownership Report (FCC Form 323) or ownership certification in accordance with 47 C.F.R. Section 73.3615(b)?

☐ Yes ☐ No

☒ Does not apply

If No, explain in an Exhibit.

Exhibit No.

7. Has an adverse finding been made or an adverse final action been taken by any court or administrative body with respect to the applicant or parties to the application in a civil or criminal proceeding, brought under the provisions of any law relating to the following: any felony; mass media related antitrust or unfair competition; fraudulent statements to another governmental unit; or discrimination?

☐ Yes ☒ No

If the answer is Yes, attach as an Exhibit a full disclosure of the persons and matters involved, including an identification of the court or administrative body and the proceeding (by dates and file numbers), and the disposition of the litigation. Where the requisite information has been earlier disclosed in connection with another application or as required by 47 U.S.C. Section 1.65(c), the applicant need only provide: (i) an identification of that previous submission by reference to the file number in the case of an application, the call letters of the station regarding which the application or Section 1.65 information was filed, and the date of filing; and (ii) the disposition of the previously reported matter.

Exhibit No.

8. Does the applicant, or any party to the application, have a petition on file to migrate to the expanded band (1605-1705 kHz) or a permit or license either in the existing band or expanded band that is held in combination (pursuant to the 5 year holding period allowed) with the AM facility proposed to be modified herein?

☐ Yes ☒ No

If Yes, provide particulars as an Exhibit.

Exhibit No.

The APPLICANT hereby waives any claim to the use of any particular frequency or of the electromagnetic spectrum as against the regulatory power of the United States because use of the same, whether by license or otherwise, and
requests and authorization in accordance with this application. (See Section 304 of the Communications Act of 1934, as amended).
The APPLICANT acknowledges that all the statements made in this application and attached exhibits are considered
material representations and that all the exhibits are a material part hereof and are incorporated herein as set out in full in

CERTIFICATION

1. By checking Yes, the applicant certifies, that, in the case of an individual applicant, he or she is not subject to a denial of federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. Section 862, or, in the case of a non-individual applicant (e.g., corporation, partnership or other unincorporated association), no party to the application is subject to a denial of federal benefits that
includes FCC benefits pursuant to that section. For the definition of a "party" for these purposes, see 47 C.F.R. Section 1.2002(b).

☒ Yes ☐ No

2. I certify that the statements in this application are true, complete, and correct to the best of my knowledge and belief, and are made in good faith.

Name	Signature	
Anne Lucey	/Alucey.	
Title	Date	Telephone Number
Assistant Secretary	11/16/09.	202-457-4505

WILLFUL FALSE STATEMENTS ON THIS FORM ARE PUNISHABLE BY FINE AND/OR IMPRISONMENT (U.S. CODE, TITLE 18, SECTION 1001), AND/OR REVOCATION OF ANY STATION LICENSE OR CONSTRUCTION

FCC NOTICE TO INDIVIDUALS REQUIRED BY THE PRIVACY ACT AND THE PAPERWORK REDUCTION ACT

The solicitation of personal information requested in this application is authorized by the Communications Act of 1934, as amended. The Commission will use the information provided in this form to determine whether grant of the application is in the public interest. In reaching that determination, or for law enforcement purposes, it may become necessary to refer personal information contained in this form to another government agency. In addition, all information provided in this form will be available for public inspection. If information requested on the form is not provided, the application may be returned without action having been taken upon it or its processing may be delayed while a request is made to provide the missing information. Your response is required to obtain the requested authorization

Public reporting burden for this collection of information is estimated to average 639 hours and 53 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, can be sent to the Federal Communications Commission, Records Management Branch, Paperwork Reduction Project (3060-0627), Washington, D. C. 20554. Do NOT send completed forms to this address.

THE FOREGOING NOTICE IS REQUIRED BY THE PRIVACY ACT OF 1974, P.L. 93-579, DECEMBER 31, 1974, 5 U.S.C. 552a(e)(3), AND THE PAPERWORK REDUCTION ACT OF 1980, P.L. 96-511, DECEMBER 11, 1980, 44 U.S.C. 3507.

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Application for License

KRAK (AM)

Hesperia, CA

910 kHz

0.7 kW Day, 0.5 kW Night DA-2

CBS Radio Stations, Inc.

November 2009

APPLICATION FOR LICENSE USING PROVISIONS OF 73.151(c)

RADIO STATION KRAK-AM Hesperia, CA
910 kHz, 0.7 kW Day, 0.5 kW Night DA-2

Purpose of Application

ORIGINAL

Purpose of Application

This engineering exhibit supports an application for license for the existing directional antenna system of radio station KRAK, Hesperia, CA . KRAK operates on 910 kHz with a daytime power of 0.7 kW and a nighttime power of 0.5 kW. Different directional antenna patterns are used for daytime and nighttime operation.

Information is provided herein demonstrating that the directional antenna parameters for the patterns authorized by the station license have been determined in accordance with the requirements of section 73.151(c) of the FCC Rules. The system has been adjusted to produce antenna monitor parameters within +/- 5 percent in ratio and +/- 3 degrees in phase of the modeled values, as required by the Rules.

All measurements used in this report were taken by Joel Saxberg and Burt Weiner on June 22 and November 2 & 3, 2009.

Benjamin F. Dawson III P.E.

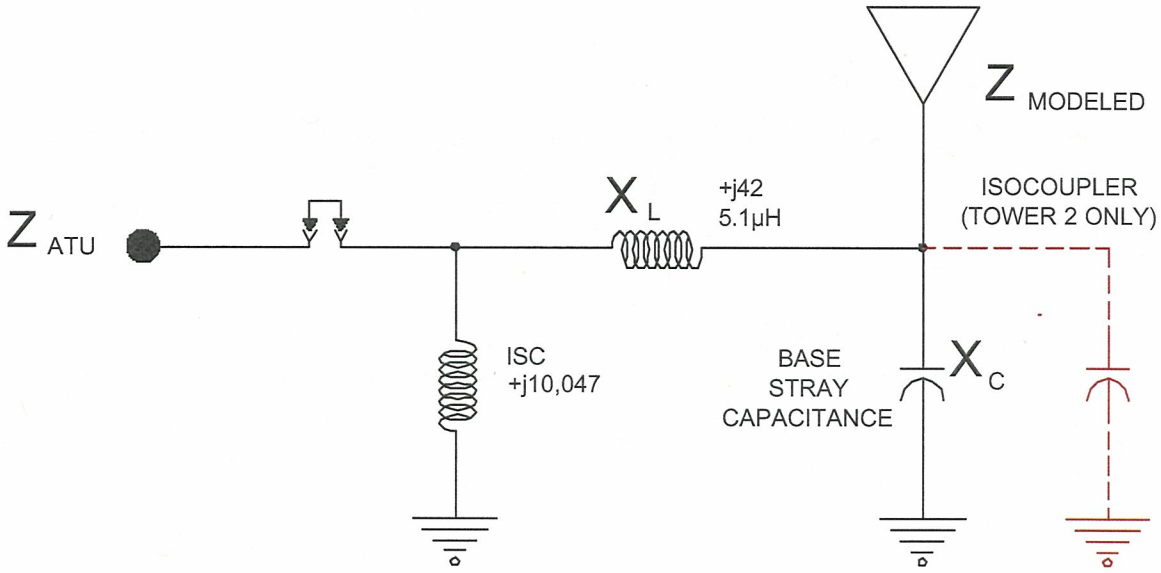
Item 1

Analysis of Tower Impedance Measurements to Verify Method of Moments Model

Tower base impedance measurements were made at the final J-plugs within the Antenna Tuning Units ("ATUs") using a Power AIM 120 vector impedance analyzer. The other towers was open circuited at the same point where impedance measurements were made for it (the "reference points") for each of the measurements.

The reference point in each ATU (the output J-plug) is followed by the shunt connection of the 1750 microhenry static drain coil, which is located within the output section of the ATU cabinet just prior to the feedline that exits the ATU enclosure and is connected to the tower above the base insulator. Circuit calculations were performed to relate the method of moments modeled impedances of the tower feedpoints to the ATU output measurement (reference) points as shown on the following pages. The Xoc shown for each tower, which was calculated for the parallel combination of the two coils in series and the assumed stray capacitance, was used in the method of moments model as a load at ground level for the open circuited case.

In addition to the page showing the schematic of the assumed circuit and tabulation of calculated values, pages showing the results of calculations using a simple circuit analysis program "NetBW" are shown. The calculations show the impedance transformation and the phase shift between the tower base values produced by the Mininec moment method model and the toroidal current transformer used to produce the antenna monitor input signals, which is located at the ATU output J-plug. The resulting impedance values are within the tolerance specified by §73.151(c)(2)(ii).



NET REACTANCE FOR "OPEN" CIRCUIT CALCULATION -j1750
(-j1165 FOR TOWER 2) PARALLED WITH ~/= +j10047 +jX $_L$
FOR EACH TOWER

TOWER	BASE X $_C$	SERIES X $_L$	Z $_{MODELED}$	Z $_{ATU\ (MODELED)}$	Z $_{ATU\ (MEASURED)}$
1	-j1750	+j45.4	41.09+j24.52	41.67+j68.96	43.3+j67.7
2	-j1165	+j42.9	40.13+j24.48	41.7+j66.4	42.3+j65.64
3	-j1750	+j41.9	39.94+j24.55	40.53+j65.6	42.34+66.14
4	-j 1750	+j43.6	41.35+j24.38	41.89+j67.0	43.67+j66.6

Bob D 11/6/2009 9:16 AM KRAK FILTER CIRCUITrev1109.dwg PDF FILE: KRAK FILTER.pdf

HATFIELD & DAWSON
CONSULTING ENGINEERS

ANALYSIS OF TOWER IMPEDANCE MEASUREMENTS TO VERIFY
METHOD OF MOMENTS MODEL

RADIO STATION KRAK 910 kHz 11/2009

NETBW CALCULATIONS OF IMPEDANCES AT ATU OUTPUT JACK (J PLUG) AS MODIFIED BY BASE CAPACITANCE, FEED PIPE INDUCTANCE, AND STATIC DRAIN INDUCTOR FOR EACH TOWER WITH THE OTHER TOWERS OPEN CIRCUITED

TOWER # 1

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	41.09	24.52	41.66498	68.96226
-1.124918				

TOWER # 2

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	40.13	24.48	41.2711	66.16826
-1.778242				

TOWER # 3

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	39.94	24.55	40.52895	65.5846
-1.093377				

TOWER # 4

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	41.35	24.38	41.93774	67.03434
-1.131916				

Item 2

Derivation of Operating Parameters for Directional Antenna - KRAK

The method of moments model of the array, following verification with the measured individual open circuited base impedances, was utilized for directional antenna calculations. Calculations were made to determine the complex voltage values for sources located at ground level under each tower of the array to produce current moment sums for the towers that, when normalized, equated to the theoretical field parameters of the authorized directional antenna pattern. With these voltage sources, the tower currents were calculated. Twenty segments were used for each tower. The currents at the tower bases (segments 1 and 21) were used to calculate the currents at the sample transformer locations at the ATU output J-plugs by Kirchoff's law.

DAY PATTERN

Tower	Modeled Current Pulse	Normalized Current Magnitude	Normalized Current Phase	Antenna Monitor Ratio	Antenna Monitor Phase
1	1	0.474	-142.1°	0.472	-142.99°
2	21	1.0	0°	1.0	0°
3	41	0.998	142.48°	1.028	141.96°
4	61	0.486	-74.44°	0.505	-75.22°

NIGHT PATTERN

Tower	Modeled Current Pulse	Normalized Current Magnitude	Normalized Current Phase	Antenna Monitor Ratio	Antenna Monitor Phase
1	1	0.642	165.23°	0.654	164.71°
2	21	1.0	0°	1.0	0°
3	41	0.727	156.02°	0.729	-156.61°
4	61	0.324	50.82°	0.322	49.01°

Base Complex I Calcs

DAY

Twr #	power from MIninec	normalized	power	r base	I base	r drive	I drive	**ratio**
1	0.000214116	0.0247023	17.29164	4.832	1.89171	5.308	1.804898	**0.4718**
2	0.00444708	0.5130553	359.1387	22.58	3.988129	24.54	3.82555	**1.0000**
3	0.003586644	0.4137877	289.6514	18.27	3.9817	18.745	3.930928	**1.0275**
4	0.000419995	0.0484544	33.91809	9.036	1.937437	9.08	1.932737	**0.5052**
total	0.008667837	0.9999998	699.9998					

	phase budget	normalized	base	network	drive	**phase normalized**
1	-87.393	-142.1	-142.1	-0.137	-141.963	**-142.99**
2	54.707	0	0	-1.028	1.028	**0.00**
3	-162.81	-217.517	142.483	-0.502	142.985	**141.96**
4	-19.73	-74.437	-74.437	-0.246	-74.191	**-75.22**

NIGHT

	power from MIninec	normalized	power	r base	I base	r drive	I drive	**ratio**
1	0.004512366	0.1892589	94.62946	9.709	3.122025	9.913	3.08966	**0.6542**
2	0.01954798	0.8198868	409.9434	17.339	4.862392	18.38	4.722687	**1.0000**
3	0.004080968	0.1711651	85.58255	6.841	3.537033	7.229	3.440753	**0.7286**
4	-0.00429903	-0.180311	-90.1556	-36.390	1.574002	-39.09	1.51867	**0.3216**
total	0.02384229	0.9999997	499.9999					

	phase budget	normalized	base	network	drive	**phase normalized**
1	-72.782	-194.774	165.226	-0.2666	165.4926	**164.71**
2	121.992	0	0	-0.7799	0.7799	**0.00**
3	-34.03	-156.022	-156.022	-0.191	-155.831	**-156.61**
4	172.81	50.818	50.818	1.025	49.793	**49.01**

NETBW CALCULATION OF IMPEDANCE AT ATU OUTPUT JACK (J PLUG) AS MODIFIED BY BASE CAPACITANCE, FEED PIPE INDUCTANCE, AND STATIC DRAIN INDUCTOR FOR EACH TOWER IN THE DRIVEN ARRAY

DAYTIME

TOWER # 1

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	4.832	106.11	5.307271	155.8892
-0.1376698				

TOWER # 2

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	22.58	59.3	24.54134	103.8459
-1.028485				

TOWER # 3

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	18.27	35.75	18.74484	77.62406
-0.5028897				

TOWER # 4

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	9.036	14.42	9.081198	57.76628
-0.2462105				

NETBW CALCULATION OF IMPEDANCE AT ATU OUTPUT JACK (J PLUG) AS MODIFIED BY BASE CAPACITANCE, FEED PIPE INDUCTANCE, AND STATIC DRAIN INDUCTOR FOR EACH TOWER IN THE DRIVEN ARRAY

NIGHTTIME

TOWER # 1

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	9.708535	31.33	9.912384	76.66478
-0.26669				

TOWER # 2

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	17.339	43.397	18.37995	86.96224
-0.7799403				

TOWER # 3

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	6.8408	66.21601	7.229125	109.489
-0.1910971				

TOWER # 4

FREQUENCY (KHZ)	LOAD RESISTANCE	LOAD REACTANCE	INPUT RESISTANCE	INPUT REACTANCE
910	-36.39	83.664	-39.09329	129.0671
-1.025205				

Item 3

Method of Moments Model Details for Towers Driven Individually - KRAK

The array of towers was modeled using MININEC
One wire was used to represent each tower. The top and bottom wire end points were specified using meters in the Cartesian coordinate system, as converted from the theoretical directional antenna specifications taking into account the carrier frequency wavelength. Each tower was modeled using 20 wire segments. As the towers are physically 91.1 degrees in electrical height, the segment length is 4.55 electrical degrees.

The tower characteristics were adjusted to provide a match of their modeled impedances, when presented to a circuit model which included branches representing the stray capacitances, feedline hookup inductances and sampling line isolation coils at the tower bases, with the base impedances that were measured at the output jacks of the Antenna Tuning Units while the other tower of the array was open circuited. The method of moments model assumed loads at ground level having the reactances that were calculated for them using the base circuit models for the open circuited towers of the array. Each tower's modeled height relative to its physical height falls within the required range of 75 to 125 percent and each modeled radius falls within the required range of 80 percent to 150 percent of the radius of a circle having a circumference equal to the sum of the widths of the tower sides. The array consists of identical, uniform cross section towers having a face width of 18 inches.

Tower	Physical Height (meters)	Modeled Height (meters)	Modeled Percentage of Height	Modeled Radius (meters)	Percent of Equivalent Radius
All	79.21	82.76	104.49	0.218	100

The following pages show the details of the method of moments models for the individually driven towers. The numerals in the file names shown on the tabulations correspond to the tower numbers.

KRAK4T1.OUT

```
                  ****************************************
                  * Mini-Numerical Electromagnetics System *
                  *       CURRENTS - LU DECOMPOSITION II   *
                  *     07-09-2009              04:25:56     *
                  ****************************************


INPUT CONFIGURATION FILE: KRAK4.CON
TOWER 1 DRIVEN OTHERS OPEN
     ********************  ANTENNA GEOMETRY  ********************
                       DIMENSIONS ARE IN METERS.

WIRE NO.  1  COORDINATES                                    CONNECTION PULSE
X             Y             Z             RADIUS          END1 END2  NO.
 0             0             0            0.2180E+00       -1     1      1
 0             0             4.138        0.2180E+00        1     1      2
 0             0             8.276        0.2180E+00        1     1      3
 0             0             12.414       0.2180E+00        1     1      4
 0             0             16.552       0.2180E+00        1     1      5
 0             0             20.69        0.2180E+00        1     1      6
 0             0             24.828       0.2180E+00        1     1      7
 0             0             28.966       0.2180E+00        1     1      8
 0             0             33.104       0.2180E+00        1     1      9
 0             0             37.242       0.2180E+00        1     1     10
 0             0             41.38        0.2180E+00        1     1     11
 0             0             45.518       0.2180E+00        1     1     12
 0             0             49.656       0.2180E+00        1     1     13
 0             0             53.794       0.2180E+00        1     1     14
 0             0             57.932       0.2180E+00        1     1     15
 0             0             62.07        0.2180E+00        1     1     16
 0             0             66.208       0.2180E+00        1     1     17
 0             0             70.346       0.2180E+00        1     1     18
 0             0             74.484       0.2180E+00        1     1     19
 0             0             78.622       0.2180E+00        1     0     20

WIRE NO.  2  COORDINATES                                    CONNECTION PULSE
X             Y             Z             RADIUS          END1 END2  NO.
 0             96.15         0            0.2180E+00       -2     2     21
 0             96.15         4.138        0.2180E+00        2     2     22
 0             96.15         8.276        0.2180E+00        2     2     23
 0             96.15         12.414       0.2180E+00        2     2     24
 0             96.15         16.552       0.2180E+00        2     2     25
 0             96.15         20.69        0.2180E+00        2     2     26
 0             96.15         24.828       0.2180E+00        2     2     27
 0             96.15         28.966       0.2180E+00        2     2     28
 0             96.15         33.104       0.2180E+00        2     2     29
 0             96.15         37.242       0.2180E+00        2     2     30
 0             96.15         41.38        0.2180E+00        2     2     31
 0             96.15         45.518       0.2180E+00        2     2     32
 0             96.15         49.656       0.2180E+00        2     2     33
 0             96.15         53.794       0.2180E+00        2     2     34
 0             96.15         57.932       0.2180E+00        2     2     35
 0             96.15         62.07        0.2180E+00        2     2     36
 0             96.15         66.208       0.2180E+00        2     2     37
 0             96.15         70.346       0.2180E+00        2     2     38
 0             96.15         74.484       0.2180E+00        2     2     39
 0             96.15         78.622       0.2180E+00        2     0     40

WIRE NO.  3  COORDINATES                                    CONNECTION PULSE
X             Y             Z             RADIUS          END1 END2  NO.
 0             192.3         0            0.2180E+00       -3     3     41
 0             192.3         4.138        0.2180E+00        3     3     42
 0             192.3         8.276        0.2180E+00        3     3     43
 0             192.3         12.414       0.2180E+00        3     3     44
 0             192.3         16.552       0.2180E+00        3     3     45
 0             192.3         20.69        0.2180E+00        3     3     46
 0             192.3         24.828       0.2180E+00        3     3     47
 0             192.3         28.966       0.2180E+00        3     3     48
 0             192.3         33.104       0.2180E+00        3     3     49
 0             192.3         37.242       0.2180E+00        3     3     50
 0             192.3         41.38        0.2180E+00        3     3     51
 0             192.3         45.518       0.2180E+00        3     3     52
 0             192.3         49.656       0.2180E+00        3     3     53
 0             192.3         53.794       0.2180E+00        3     3     54
 0             192.3         57.932       0.2180E+00        3     3     55
 0             192.3         62.07        0.2180E+00        3     3     56
```

0	192.3	66.208	0.2180E+00	3	3	57
0	192.3	70.346	0.2180E+00	3	3	58
0	192.3	74.484	0.2180E+00	3	3	59
0	192.3	78.622	0.2180E+00	3	0	60

WIRE NO. 4 COORDINATES

X	Y	Z	RADIUS	CONNECTION END1	CONNECTION END2	PULSE NO.
0	288.46	0	0.2180E+00	-4	4	61
0	288.46	4.138	0.2180E+00	4	4	62
0	288.46	8.276	0.2180E+00	4	4	63
0	288.46	12.414	0.2180E+00	4	4	64
0	288.46	16.552	0.2180E+00	4	4	65
0	288.46	20.69	0.2180E+00	4	4	66
0	288.46	24.828	0.2180E+00	4	4	67
0	288.46	28.966	0.2180E+00	4	4	68
0	288.46	33.104	0.2180E+00	4	4	69
0	288.46	37.242	0.2180E+00	4	4	70
0	288.46	41.38	0.2180E+00	4	4	71
0	288.46	45.518	0.2180E+00	4	4	72
0	288.46	49.656	0.2180E+00	4	4	73
0	288.46	53.794	0.2180E+00	4	4	74
0	288.46	57.932	0.2180E+00	4	4	75
0	288.46	62.07	0.2180E+00	4	4	76
0	288.46	66.208	0.2180E+00	4	4	77
0	288.46	70.346	0.2180E+00	4	4	78
0	288.46	74.484	0.2180E+00	4	4	79
0	288.46	78.622	0.2180E+00	4	0	80

********** ENVIRONMENT **********

ENVIRONMENT HAS A GROUND PLANE.

********** FREQUENCY **********

FREQUENCY = .91 MHZ
WAVELENGTH = 329.4505 METERS

********** SOURCES **********

NO. OF SOURCES : 1
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES): 1 , 1 , 0

********** LOADING **********

NUMBER OF LOADS : 3

LOAD NO. 1
PULSE NO.,RESISTANCE,REACTANCE: 21 , 0 ,-1317

LOAD NO. 2
PULSE NO.,RESISTANCE,REACTANCE: 41 , 0 ,-2117

LOAD NO. 3
PULSE NO.,RESISTANCE,REACTANCE: 61 , 0 ,-2117

********** SOURCE SOLUTION **********

PULSE 1 VOLTAGE = (1 , 0 J)
CURRENT = (.0179458 ,-1.070725E-02 J)
IMPEDANCE = (41.0944 , 24.51872 J)
POWER = 8.972899E-03

KRAK4T2.OUT

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                    ****************************************
                    * Mini-Numerical Electromagnetics System *
                    *       CURRENTS - LU DECOMPOSITION II   *
                    *     07-09-2009           04:28:03      *
                    ****************************************
```

INPUT CONFIGURATION FILE: KRAK4.CON
TOWER 2 DRIVEN OTHERS OPEN

********** ANTENNA GEOMETRY **********

DIMENSIONS ARE IN METERS.

WIRE NO. 1 COORDINATES X	Y	Z	RADIUS	CONNECTION END1	END2	PULSE NO.
0	0	0	0.2180E+00	-1	1	1
0	0	4.138	0.2180E+00	1	1	2
0	0	8.276	0.2180E+00	1	1	3
0	0	12.414	0.2180E+00	1	1	4
0	0	16.552	0.2180E+00	1	1	5
0	0	20.69	0.2180E+00	1	1	6
0	0	24.828	0.2180E+00	1	1	7
0	0	28.966	0.2180E+00	1	1	8
0	0	33.104	0.2180E+00	1	1	9
0	0	37.242	0.2180E+00	1	1	10
0	0	41.38	0.2180E+00	1	1	11
0	0	45.518	0.2180E+00	1	1	12
0	0	49.656	0.2180E+00	1	1	13
0	0	53.794	0.2180E+00	1	1	14
0	0	57.932	0.2180E+00	1	1	15
0	0	62.07	0.2180E+00	1	1	16
0	0	66.208	0.2180E+00	1	1	17
0	0	70.346	0.2180E+00	1	1	18
0	0	74.484	0.2180E+00	1	1	19
0	0	78.622	0.2180E+00	1	0	20

WIRE NO. 2 COORDINATES X	Y	Z	RADIUS	CONNECTION END1	END2	PULSE NO.
0	96.15	0	0.2180E+00	-2	2	21
0	96.15	4.138	0.2180E+00	2	2	22
0	96.15	8.276	0.2180E+00	2	2	23
0	96.15	12.414	0.2180E+00	2	2	24
0	96.15	16.552	0.2180E+00	2	2	25
0	96.15	20.69	0.2180E+00	2	2	26
0	96.15	24.828	0.2180E+00	2	2	27
0	96.15	28.966	0.2180E+00	2	2	28
0	96.15	33.104	0.2180E+00	2	2	29
0	96.15	37.242	0.2180E+00	2	2	30
0	96.15	41.38	0.2180E+00	2	2	31
0	96.15	45.518	0.2180E+00	2	2	32
0	96.15	49.656	0.2180E+00	2	2	33
0	96.15	53.794	0.2180E+00	2	2	34
0	96.15	57.932	0.2180E+00	2	2	35
0	96.15	62.07	0.2180E+00	2	2	36
0	96.15	66.208	0.2180E+00	2	2	37
0	96.15	70.346	0.2180E+00	2	2	38
0	96.15	74.484	0.2180E+00	2	2	39
0	96.15	78.622	0.2180E+00	2	0	40

WIRE NO. 3 COORDINATES X	Y	Z	RADIUS	CONNECTION END1	END2	PULSE NO.
0	192.3	0	0.2180E+00	-3	3	41
0	192.3	4.138	0.2180E+00	3	3	42
0	192.3	8.276	0.2180E+00	3	3	43
0	192.3	12.414	0.2180E+00	3	3	44
0	192.3	16.552	0.2180E+00	3	3	45
0	192.3	20.69	0.2180E+00	3	3	46
0	192.3	24.828	0.2180E+00	3	3	47
0	192.3	28.966	0.2180E+00	3	3	48
0	192.3	33.104	0.2180E+00	3	3	49
0	192.3	37.242	0.2180E+00	3	3	50
0	192.3	41.38	0.2180E+00	3	3	51
0	192.3	45.518	0.2180E+00	3	3	52
0	192.3	49.656	0.2180E+00	3	3	53
0	192.3	53.794	0.2180E+00	3	3	54
0	192.3	57.932	0.2180E+00	3	3	55
0	192.3	62.07	0.2180E+00	3	3	56

0	192.3	66.208	0.2180E+00	3	3	57
0	192.3	70.346	0.2180E+00	3	3	58
0	192.3	74.484	0.2180E+00	3	3	59
0	192.3	78.622	0.2180E+00	3	0	60

WIRE NO. 4 COORDINATES

X	Y	Z	RADIUS	CONNECTION END1	CONNECTION END2	PULSE NO.
0	288.46	0	0.2180E+00	-4	4	61
0	288.46	4.138	0.2180E+00	4	4	62
0	288.46	8.276	0.2180E+00	4	4	63
0	288.46	12.414	0.2180E+00	4	4	64
0	288.46	16.552	0.2180E+00	4	4	65
0	288.46	20.69	0.2180E+00	4	4	66
0	288.46	24.828	0.2180E+00	4	4	67
0	288.46	28.966	0.2180E+00	4	4	68
0	288.46	33.104	0.2180E+00	4	4	69
0	288.46	37.242	0.2180E+00	4	4	70
0	288.46	41.38	0.2180E+00	4	4	71
0	288.46	45.518	0.2180E+00	4	4	72
0	288.46	49.656	0.2180E+00	4	4	73
0	288.46	53.794	0.2180E+00	4	4	74
0	288.46	57.932	0.2180E+00	4	4	75
0	288.46	62.07	0.2180E+00	4	4	76
0	288.46	66.208	0.2180E+00	4	4	77
0	288.46	70.346	0.2180E+00	4	4	78
0	288.46	74.484	0.2180E+00	4	4	79
0	288.46	78.622	0.2180E+00	4	0	80

********** ENVIRONMENT **********

ENVIRONMENT HAS A GROUND PLANE.

********** FREQUENCY **********

FREQUENCY = .91 MHZ
WAVELENGTH = 329.4505 METERS

********** SOURCES **********

NO. OF SOURCES : 1
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES): 21 , 1 , 0

********** LOADING **********

NUMBER OF LOADS : 3

LOAD NO. 1
PULSE NO.,RESISTANCE,REACTANCE: 1 , 0 ,-2117

LOAD NO. 2
PULSE NO.,RESISTANCE,REACTANCE: 41 , 0 ,-2117

LOAD NO. 3
PULSE NO.,RESISTANCE,REACTANCE: 61 , 0 ,-2117

********** SOURCE SOLUTION **********

PULSE 21 VOLTAGE = (1 , 0 J)
CURRENT = (1.816039E-02 ,-1.108059E-02 J)
IMPEDANCE = (40.12643 , 24.48321 J)
POWER = 9.080195E-03

KRAK4T3.OUT

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                    ****************************************
                    * Mini-Numerical Electromagnetics System *
                    *       CURRENTS - LU DECOMPOSITION II   *
                    *     07-09-2009           04:29:35      *
                    ****************************************


INPUT CONFIGURATION FILE: KRAK4.CON
TOWER 3 DRIVEN OTHERS OPEN
     ********************  ANTENNA GEOMETRY  ********************
                       DIMENSIONS ARE IN METERS.

WIRE NO.   1  COORDINATES                                        CONNECTION  PULSE
X              Y              Z              RADIUS             END1 END2   NO.
 0              0              0             0.2180E+00          -1     1      1
 0              0              4.138         0.2180E+00           1     1      2
 0              0              8.276         0.2180E+00           1     1      3
 0              0              12.414        0.2180E+00           1     1      4
 0              0              16.552        0.2180E+00           1     1      5
 0              0              20.69         0.2180E+00           1     1      6
 0              0              24.828        0.2180E+00           1     1      7
 0              0              28.966        0.2180E+00           1     1      8
 0              0              33.104        0.2180E+00           1     1      9
 0              0              37.242        0.2180E+00           1     1     10
 0              0              41.38         0.2180E+00           1     1     11
 0              0              45.518        0.2180E+00           1     1     12
 0              0              49.656        0.2180E+00           1     1     13
 0              0              53.794        0.2180E+00           1     1     14
 0              0              57.932        0.2180E+00           1     1     15
 0              0              62.07         0.2180E+00           1     1     16
 0              0              66.208        0.2180E+00           1     1     17
 0              0              70.346        0.2180E+00           1     1     18
 0              0              74.484        0.2180E+00           1     1     19
 0              0              78.622        0.2180E+00           1     0     20

WIRE NO.   2  COORDINATES                                        CONNECTION  PULSE
X              Y              Z              RADIUS             END1 END2   NO.
 0              96.15          0             0.2180E+00          -2     2     21
 0              96.15          4.138         0.2180E+00           2     2     22
 0              96.15          8.276         0.2180E+00           2     2     23
 0              96.15          12.414        0.2180E+00           2     2     24
 0              96.15          16.552        0.2180E+00           2     2     25
 0              96.15          20.69         0.2180E+00           2     2     26
 0              96.15          24.828        0.2180E+00           2     2     27
 0              96.15          28.966        0.2180E+00           2     2     28
 0              96.15          33.104        0.2180E+00           2     2     29
 0              96.15          37.242        0.2180E+00           2     2     30
 0              96.15          41.38         0.2180E+00           2     2     31
 0              96.15          45.518        0.2180E+00           2     2     32
 0              96.15          49.656        0.2180E+00           2     2     33
 0              96.15          53.794        0.2180E+00           2     2     34
 0              96.15          57.932        0.2180E+00           2     2     35
 0              96.15          62.07         0.2180E+00           2     2     36
 0              96.15          66.208        0.2180E+00           2     2     37
 0              96.15          70.346        0.2180E+00           2     2     38
 0              96.15          74.484        0.2180E+00           2     2     39
 0              96.15          78.622        0.2180E+00           2     0     40

WIRE NO.   3  COORDINATES                                        CONNECTION  PULSE
X              Y              Z              RADIUS             END1 END2   NO.
 0              192.3          0             0.2180E+00          -3     3     41
 0              192.3          4.138         0.2180E+00           3     3     42
 0              192.3          8.276         0.2180E+00           3     3     43
 0              192.3          12.414        0.2180E+00           3     3     44
 0              192.3          16.552        0.2180E+00           3     3     45
 0              192.3          20.69         0.2180E+00           3     3     46
 0              192.3          24.828        0.2180E+00           3     3     47
 0              192.3          28.966        0.2180E+00           3     3     48
 0              192.3          33.104        0.2180E+00           3     3     49
 0              192.3          37.242        0.2180E+00           3     3     50
 0              192.3          41.38         0.2180E+00           3     3     51
 0              192.3          45.518        0.2180E+00           3     3     52
 0              192.3          49.656        0.2180E+00           3     3     53
 0              192.3          53.794        0.2180E+00           3     3     54
 0              192.3          57.932        0.2180E+00           3     3     55
 0              192.3          62.07         0.2180E+00           3     3     56
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 0              192.3          66.208         0.2180E+00       3      3      57
 0              192.3          70.346         0.2180E+00       3      3      58
 0              192.3          74.484         0.2180E+00       3      3      59
 0              192.3          78.622         0.2180E+00       3      0      60

WIRE NO.  4  COORDINATES                                        CONNECTION PULSE
X              Y              Z              RADIUS           END1 END2  NO.
 0              288.46         0              0.2180E+00       -4     4      61
 0              288.46         4.138          0.2180E+00        4     4      62
 0              288.46         8.276          0.2180E+00        4     4      63
 0              288.46         12.414         0.2180E+00        4     4      64
 0              288.46         16.552         0.2180E+00        4     4      65
 0              288.46         20.69          0.2180E+00        4     4      66
 0              288.46         24.828         0.2180E+00        4     4      67
 0              288.46         28.966         0.2180E+00        4     4      68
 0              288.46         33.104         0.2180E+00        4     4      69
 0              288.46         37.242         0.2180E+00        4     4      70
 0              288.46         41.38          0.2180E+00        4     4      71
 0              288.46         45.518         0.2180E+00        4     4      72
 0              288.46         49.656         0.2180E+00        4     4      73
 0              288.46         53.794         0.2180E+00        4     4      74
 0              288.46         57.932         0.2180E+00        4     4      75
 0              288.46         62.07          0.2180E+00        4     4      76
 0              288.46         66.208         0.2180E+00        4     4      77
 0              288.46         70.346         0.2180E+00        4     4      78
 0              288.46         74.484         0.2180E+00        4     4      79
 0              288.46         78.622         0.2180E+00        4     0      80

     **********************    ENVIRONMENT     **********************

                  ENVIRONMENT HAS A GROUND PLANE.

     **********************      FREQUENCY      **********************

                 FREQUENCY    =  .91  MHZ
                 WAVELENGTH =  329.4505  METERS

     **********************     SOURCES         **********************


NO. OF SOURCES :  1
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES):  41 , 1 , 0

     **********************      LOADING        **********************

NUMBER OF LOADS    : 3

LOAD NO.   1
PULSE NO.,RESISTANCE,REACTANCE:  1 , 0 ,-2117

LOAD NO.   2
PULSE NO.,RESISTANCE,REACTANCE:  21 , 0 ,-1317

LOAD NO.   3
PULSE NO.,RESISTANCE,REACTANCE:  61 , 0 ,-2117

     **********************  SOURCE SOLUTION   **********************

PULSE  41      VOLTAGE = ( 1 , 0 J)
               CURRENT = ( 1.817258E-02 ,-1.116742E-02 J)
               IMPEDANCE = ( 39.94379 , 24.54627 J)
               POWER =  9.086289E-03
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KRAK4T4.OUT

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                    ****************************************
                    * Mini-Numerical Electromagnetics System *
                    *       CURRENTS - LU DECOMPOSITION II   *
                    *     07-09-2009          04:31:41       *
                    ****************************************
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INPUT CONFIGURATION FILE: KRAK4.CON
TOWER 4 DRIVEN OTHERS OPEN

********** ANTENNA GEOMETRY **********

DIMENSIONS ARE IN METERS.

WIRE NO. 1 COORDINATES X	Y	Z	RADIUS	CONNECTION END1	END2	PULSE NO.
0	0	0	0.2180E+00	-1	1	1
0	0	4.138	0.2180E+00	1	1	2
0	0	8.276	0.2180E+00	1	1	3
0	0	12.414	0.2180E+00	1	1	4
0	0	16.552	0.2180E+00	1	1	5
0	0	20.69	0.2180E+00	1	1	6
0	0	24.828	0.2180E+00	1	1	7
0	0	28.966	0.2180E+00	1	1	8
0	0	33.104	0.2180E+00	1	1	9
0	0	37.242	0.2180E+00	1	1	10
0	0	41.38	0.2180E+00	1	1	11
0	0	45.518	0.2180E+00	1	1	12
0	0	49.656	0.2180E+00	1	1	13
0	0	53.794	0.2180E+00	1	1	14
0	0	57.932	0.2180E+00	1	1	15
0	0	62.07	0.2180E+00	1	1	16
0	0	66.208	0.2180E+00	1	1	17
0	0	70.346	0.2180E+00	1	1	18
0	0	74.484	0.2180E+00	1	1	19
0	0	78.622	0.2180E+00	1	0	20

WIRE NO. 2 COORDINATES X	Y	Z	RADIUS	CONNECTION END1	END2	PULSE NO.
0	96.15	0	0.2180E+00	-2	2	21
0	96.15	4.138	0.2180E+00	2	2	22
0	96.15	8.276	0.2180E+00	2	2	23
0	96.15	12.414	0.2180E+00	2	2	24
0	96.15	16.552	0.2180E+00	2	2	25
0	96.15	20.69	0.2180E+00	2	2	26
0	96.15	24.828	0.2180E+00	2	2	27
0	96.15	28.966	0.2180E+00	2	2	28
0	96.15	33.104	0.2180E+00	2	2	29
0	96.15	37.242	0.2180E+00	2	2	30
0	96.15	41.38	0.2180E+00	2	2	31
0	96.15	45.518	0.2180E+00	2	2	32
0	96.15	49.656	0.2180E+00	2	2	33
0	96.15	53.794	0.2180E+00	2	2	34
0	96.15	57.932	0.2180E+00	2	2	35
0	96.15	62.07	0.2180E+00	2	2	36
0	96.15	66.208	0.2180E+00	2	2	37
0	96.15	70.346	0.2180E+00	2	2	38
0	96.15	74.484	0.2180E+00	2	2	39
0	96.15	78.622	0.2180E+00	2	0	40

WIRE NO. 3 COORDINATES X	Y	Z	RADIUS	CONNECTION END1	END2	PULSE NO.
0	192.3	0	0.2180E+00	-3	3	41
0	192.3	4.138	0.2180E+00	3	3	42
0	192.3	8.276	0.2180E+00	3	3	43
0	192.3	12.414	0.2180E+00	3	3	44
0	192.3	16.552	0.2180E+00	3	3	45
0	192.3	20.69	0.2180E+00	3	3	46
0	192.3	24.828	0.2180E+00	3	3	47
0	192.3	28.966	0.2180E+00	3	3	48
0	192.3	33.104	0.2180E+00	3	3	49
0	192.3	37.242	0.2180E+00	3	3	50
0	192.3	41.38	0.2180E+00	3	3	51
0	192.3	45.518	0.2180E+00	3	3	52
0	192.3	49.656	0.2180E+00	3	3	53
0	192.3	53.794	0.2180E+00	3	3	54
0	192.3	57.932	0.2180E+00	3	3	55
0	192.3	62.07	0.2180E+00	3	3	56

0	192.3	66.208	0.2180E+00	3	3	57
0	192.3	70.346	0.2180E+00	3	3	58
0	192.3	74.484	0.2180E+00	3	3	59
0	192.3	78.622	0.2180E+00	3	0	60

WIRE NO. 4 COORDINATES

X	Y	Z	RADIUS	CONNECTION END1	CONNECTION END2	PULSE NO.
0	288.46	0	0.2180E+00	-4	4	61
0	288.46	4.138	0.2180E+00	4	4	62
0	288.46	8.276	0.2180E+00	4	4	63
0	288.46	12.414	0.2180E+00	4	4	64
0	288.46	16.552	0.2180E+00	4	4	65
0	288.46	20.69	0.2180E+00	4	4	66
0	288.46	24.828	0.2180E+00	4	4	67
0	288.46	28.966	0.2180E+00	4	4	68
0	288.46	33.104	0.2180E+00	4	4	69
0	288.46	37.242	0.2180E+00	4	4	70
0	288.46	41.38	0.2180E+00	4	4	71
0	288.46	45.518	0.2180E+00	4	4	72
0	288.46	49.656	0.2180E+00	4	4	73
0	288.46	53.794	0.2180E+00	4	4	74
0	288.46	57.932	0.2180E+00	4	4	75
0	288.46	62.07	0.2180E+00	4	4	76
0	288.46	66.208	0.2180E+00	4	4	77
0	288.46	70.346	0.2180E+00	4	4	78
0	288.46	74.484	0.2180E+00	4	4	79
0	288.46	78.622	0.2180E+00	4	0	80

********** ENVIRONMENT **********

ENVIRONMENT HAS A GROUND PLANE.

********** FREQUENCY **********

FREQUENCY = .91 MHZ
WAVELENGTH = 329.4505 METERS

********** SOURCES **********

NO. OF SOURCES : 1
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES): 61 , 1 , 0

********** LOADING **********

NUMBER OF LOADS : 3

LOAD NO. 1
PULSE NO.,RESISTANCE,REACTANCE: 1 , 0 ,-2117

LOAD NO. 2
PULSE NO.,RESISTANCE,REACTANCE: 21 , 0 ,-1317

LOAD NO. 3
PULSE NO.,RESISTANCE,REACTANCE: 41 , 0 ,-2117

********** SOURCE SOLUTION **********

PULSE 61 VOLTAGE = (1 , 0 J)
CURRENT = (1.794526E-02 ,-1.057847E-02 J)
IMPEDANCE = (41.35459 , 24.37792 J)
POWER = 8.972632E-03

Item 4

Method of Moments Model Details for Directional Antenna- KRAK

The array of towers was modeled using MININEC with the individual tower characteristics that were verified by the individual tower impedance measurements. Calculations were made to determine the complex voltage values for sources located at ground level under each tower of the array to produce current moment sums for the towers that, when normalized, equated to the theoretical field parameters of the authorized directional antenna pattern. The following pages contain details of the method of moments model of the directional antenna pattern.

Tower	Wire	Base Node
1	1	1
2	2	21
3	3	41
4	4	61

KRAK4D.OUT

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                    ****************************************
                    * Mini-Numerical Electromagnetics System *
                    *       CURRENTS - LU DECOMPOSITION II   *
                    *     07-09-2009            04:37:57     *
                    ****************************************


INPUT CONFIGURATION FILE: KRAK4.CON
DAY PATTERN DRIVE VALUES
     *********************  ANTENNA GEOMETRY  *********************
                        DIMENSIONS ARE IN METERS.

WIRE NO.   1  COORDINATES                                    CONNECTION  PULSE
X              Y              Z              RADIUS          END1 END2   NO.
 0              0              0             0.2180E+00       -1     1       1
 0              0              4.138         0.2180E+00        1     1       2
 0              0              8.276         0.2180E+00        1     1       3
 0              0              12.414        0.2180E+00        1     1       4
 0              0              16.552        0.2180E+00        1     1       5
 0              0              20.69         0.2180E+00        1     1       6
 0              0              24.828        0.2180E+00        1     1       7
 0              0              28.966        0.2180E+00        1     1       8
 0              0              33.104        0.2180E+00        1     1       9
 0              0              37.242        0.2180E+00        1     1      10
 0              0              41.38         0.2180E+00        1     1      11
 0              0              45.518        0.2180E+00        1     1      12
 0              0              49.656        0.2180E+00        1     1      13
 0              0              53.794        0.2180E+00        1     1      14
 0              0              57.932        0.2180E+00        1     1      15
 0              0              62.07         0.2180E+00        1     1      16
 0              0              66.208        0.2180E+00        1     1      17
 0              0              70.346        0.2180E+00        1     1      18
 0              0              74.484        0.2180E+00        1     1      19
 0              0              78.622        0.2180E+00        1     0      20

WIRE NO.   2  COORDINATES                                    CONNECTION  PULSE
X              Y              Z              RADIUS          END1 END2   NO.
 0              96.15          0             0.2180E+00       -2     2      21
 0              96.15          4.138         0.2180E+00        2     2      22
 0              96.15          8.276         0.2180E+00        2     2      23
 0              96.15          12.414        0.2180E+00        2     2      24
 0              96.15          16.552        0.2180E+00        2     2      25
 0              96.15          20.69         0.2180E+00        2     2      26
 0              96.15          24.828        0.2180E+00        2     2      27
 0              96.15          28.966        0.2180E+00        2     2      28
 0              96.15          33.104        0.2180E+00        2     2      29
 0              96.15          37.242        0.2180E+00        2     2      30
 0              96.15          41.38         0.2180E+00        2     2      31
 0              96.15          45.518        0.2180E+00        2     2      32
 0              96.15          49.656        0.2180E+00        2     2      33
 0              96.15          53.794        0.2180E+00        2     2      34
 0              96.15          57.932        0.2180E+00        2     2      35
 0              96.15          62.07         0.2180E+00        2     2      36
 0              96.15          66.208        0.2180E+00        2     2      37
 0              96.15          70.346        0.2180E+00        2     2      38
 0              96.15          74.484        0.2180E+00        2     2      39
 0              96.15          78.622        0.2180E+00        2     0      40

WIRE NO.   3  COORDINATES                                    CONNECTION  PULSE
X              Y              Z              RADIUS          END1 END2   NO.
 0              192.3          0             0.2180E+00       -3     3      41
 0              192.3          4.138         0.2180E+00        3     3      42
 0              192.3          8.276         0.2180E+00        3     3      43
 0              192.3          12.414        0.2180E+00        3     3      44
 0              192.3          16.552        0.2180E+00        3     3      45
 0              192.3          20.69         0.2180E+00        3     3      46
 0              192.3          24.828        0.2180E+00        3     3      47
 0              192.3          28.966        0.2180E+00        3     3      48
 0              192.3          33.104        0.2180E+00        3     3      49
 0              192.3          37.242        0.2180E+00        3     3      50
 0              192.3          41.38         0.2180E+00        3     3      51
 0              192.3          45.518        0.2180E+00        3     3      52
 0              192.3          49.656        0.2180E+00        3     3      53
 0              192.3          53.794        0.2180E+00        3     3      54
 0              192.3          57.932        0.2180E+00        3     3      55
 0              192.3          62.07         0.2180E+00        3     3      56
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 0              192.3          66.208         0.2180E+00       3      3      57
 0              192.3          70.346         0.2180E+00       3      3      58
 0              192.3          74.484         0.2180E+00       3      3      59
 0              192.3          78.622         0.2180E+00       3      0      60

WIRE NO.  4  COORDINATES                                        CONNECTION  PULSE
X              Y              Z              RADIUS           END1  END2   NO.
 0              288.46         0              0.2180E+00       -4     4      61
 0              288.46         4.138          0.2180E+00        4     4      62
 0              288.46         8.276          0.2180E+00        4     4      63
 0              288.46         12.414         0.2180E+00        4     4      64
 0              288.46         16.552         0.2180E+00        4     4      65
 0              288.46         20.69          0.2180E+00        4     4      66
 0              288.46         24.828         0.2180E+00        4     4      67
 0              288.46         28.966         0.2180E+00        4     4      68
 0              288.46         33.104         0.2180E+00        4     4      69
 0              288.46         37.242         0.2180E+00        4     4      70
 0              288.46         41.38          0.2180E+00        4     4      71
 0              288.46         45.518         0.2180E+00        4     4      72
 0              288.46         49.656         0.2180E+00        4     4      73
 0              288.46         53.794         0.2180E+00        4     4      74
 0              288.46         57.932         0.2180E+00        4     4      75
 0              288.46         62.07          0.2180E+00        4     4      76
 0              288.46         66.208         0.2180E+00        4     4      77
 0              288.46         70.346         0.2180E+00        4     4      78
 0              288.46         74.484         0.2180E+00        4     4      79
 0              288.46         78.622         0.2180E+00        4     0      80

     **********************    ENVIRONMENT     **********************

                    ENVIRONMENT HAS A GROUND PLANE.

     **********************       FREQUENCY      **********************

                    FREQUENCY    =  .91  MHZ
                    WAVELENGTH =  329.4505  METERS

     **********************      SOURCES         **********************


NO. OF SOURCES :  4
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES):  1 , 1 , 0
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES):  21 , 1.25984 , 123.87
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES):  41 , .79548 ,-99.885
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES):  61 , .164131 , 38.205

     **********************      LOADING         **********************

NUMBER OF LOADS    : 0

     **********************  SOURCE SOLUTION    **********************

PULSE  1       VOLTAGE = ( 1 , 0 J)
               CURRENT = ( 4.282319E-04 ,-9.404159E-03 J)
               IMPEDANCE = ( 4.832139 , 106.1159 J)
               POWER =  2.141159E-04

PULSE  21      VOLTAGE = (-.702122 , 1.04605 J)
               CURRENT = ( 1.146639E-02 , 1.619899E-02 J)
               IMPEDANCE = ( 22.58058 , 59.32712 J)
               POWER =  4.447081E-03

PULSE  41      VOLTAGE = (-.136561 ,-.7836705 J)
               CURRENT = (-1.892976E-02 ,-5.854782E-03 J)
               IMPEDANCE = ( 18.27057 , 35.74796 J)
               POWER =  3.586644E-03

PULSE  61      VOLTAGE = ( .1289746 , .1015112 J)
               CURRENT = ( 9.075153E-03 ,-3.255538E-03 J)
               IMPEDANCE = ( 9.036344 , 14.42724 J)
               POWER =  4.199953E-04

    TOTAL POWER =  8.667837E-03 WATTS
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********** CURRENT SOLUTION **********

WIRE NO. 1 :

PULSE NO.	REAL (AMPS)	IMAGINARY (AMPS)	MAGNITUDE (AMPS)	PHASE (DEGREES)
1	4.282319E-04	-9.404159E-03	9.413905E-03	-87.39275
2	4.27057E-04	-9.848455E-03	9.85771E-03	-87.51705
3	4.23537E-04	-1.006935E-02	1.007825E-02	-87.59145
4	4.176855E-04	-1.017955E-02	1.018811E-02	-87.65037
5	4.09525E-04	-1.019395E-02	1.020217E-02	-87.69948
6	3.990874E-04	-1.011933E-02	1.012719E-02	-87.74153
7	3.864122E-04	-9.959673E-03	9.967166E-03	-87.77818
8	3.71548E-04	-9.718006E-03	9.725107E-03	-87.81048
9	3.545506E-04	-9.397003E-03	9.403689E-03	-87.83925
10	3.354838E-04	-8.999282E-03	9.005534E-03	-87.86507
11	3.144171E-04	-8.527522E-03	8.533317E-03	-87.88841
12	2.914267E-04	-7.984488E-03	7.989804E-03	-87.90968
13	2.665916E-04	-7.373013E-03	7.377831E-03	-87.92921
14	2.399927E-04	-6.695919E-03	6.700219E-03	-87.9473
15	2.117073E-04	-5.955868E-03	5.95963E-03	-87.96423
16	1.818023E-04	-5.155097E-03	5.158301E-03	-87.98022
17	1.503169E-04	-4.294897E-03	4.297527E-03	-87.99553
18	1.172277E-04	-3.374517E-03	3.376553E-03	-88.0104
19	8.235547E-05	-2.388338E-03	2.389757E-03	-88.02509
20	4.508842E-05	-1.317545E-03	1.318316E-03	-88.04002
E	0	0	0	0

WIRE NO.: 1 MAGNITUDE = .6056485 PHASE = -87.79162

WIRE NO. 2 :

PULSE NO.	REAL (AMPS)	IMAGINARY (AMPS)	MAGNITUDE (AMPS)	PHASE (DEGREES)
21	1.146639E-02	1.619899E-02	1.984655E-02	54.7074
22	1.192649E-02	1.648346E-02	2.034565E-02	54.11266
23	1.214359E-02	1.655624E-02	2.053232E-02	53.74088
24	1.223568E-02	1.649693E-02	2.053925E-02	53.43587
25	1.221848E-02	1.631672E-02	2.038447E-02	53.17297
26	1.209922E-02	1.602138E-02	2.007675E-02	52.94019
27	1.188232E-02	1.561501E-02	1.962188E-02	52.73048
28	1.157119E-02	1.510127E-02	1.902474E-02	52.53925
29	1.116893E-02	1.448383E-02	1.829006E-02	52.36308
30	.0106786	1.376653E-02	1.742268E-02	52.19951
31	1.010339E-02	1.295342E-02	1.642771E-02	52.04653
32	9.446578E-03	1.204877E-02	1.531048E-02	51.90255
33	8.711519E-03	1.105697E-02	1.407647E-02	51.76628
34	7.901581E-03	9.982401E-03	1.273119E-02	51.63658
35	7.019926E-03	8.829218E-03	1.127983E-02	51.51253
36	6.069218E-03	7.600949E-03	9.726759E-03	51.39328
37	5.051009E-03	6.299742E-03	8.074617E-03	51.27805
38	3.96446E-03	4.924831E-03	6.322254E-03	51.16614
39	2.803038E-03	3.468471E-03	4.459519E-03	51.05665
40	1.544779E-03	1.904093E-03	2.45192E-03	50.94778
E	0	0	0	0

WIRE NO.: 2 MAGNITUDE = 1.187538 PHASE = 52.60848

WIRE NO. 3 :

PULSE NO.	REAL (AMPS)	IMAGINARY (AMPS)	MAGNITUDE (AMPS)	PHASE (DEGREES)
41	-1.892976E-02	-5.854782E-03	.0198145	-162.8137
42	-1.924486E-02	-5.773596E-03	2.009226E-02	-163.3004
43	-1.931887E-02	-5.682013E-03	2.013713E-02	-163.6105
44	-1.924066E-02	-5.564972E-03	2.002927E-02	-163.8686
45	-1.902277E-02	-5.421001E-03	1.978012E-02	-164.0938
46	-1.867174E-02	-5.249948E-03	1.939577E-02	-164.2956
47	-1.819224E-02	-5.052248E-03	1.888076E-02	-164.4793
48	-1.758853E-02	-4.828669E-03	1.823931E-02	-164.6485
49	-1.686483E-02	-4.580204E-03	1.747571E-02	-164.8059
50	-1.602558E-02	-4.308013E-03	1.659452E-02	-164.9534
51	-1.507552E-02	-4.013389E-03	.0156006	-165.0925
52	-1.401963E-02	-3.697717E-03	1.449907E-02	-165.2246
53	-1.286298E-02	-3.362429E-03	1.329519E-02	-165.3505
54	-1.161069E-02	-3.008963E-03	1.199424E-02	-165.4712
55	-1.026757E-02	-2.638683E-03	1.060121E-02	-165.5873
56	-8.837729E-03	-2.252763E-03	9.120328E-03	-165.6997
57	-7.323651E-03	-1.851979E-03	7.554184E-03	-165.8087
58	-5.724424E-03	-1.436265E-03	5.901855E-03	-165.9152
59	-4.031048E-03	-1.003586E-03	4.154098E-03	-166.0196
60	-2.212639E-03	-5.465993E-04	2.279154E-03	-166.1237

```
E               0              0              0              0
WIRE NO.: 3 MAGNITUDE =  1.140033 PHASE = -164.5916

WIRE NO.  4 :
PULSE          REAL           IMAGINARY      MAGNITUDE      PHASE
 NO.           (AMPS)         (AMPS)         (AMPS)         (DEGREES)
 61             9.075153E-03 -3.255538E-03  9.641417E-03 -19.73448
 62             9.096908E-03 -3.307084E-03  9.679388E-03 -19.9782
 63             9.04942E-03  -3.318327E-03  9.638636E-03 -20.13746
 64             8.944512E-03 -3.303889E-03  9.535197E-03 -20.27303
 65             8.784342E-03 -3.265832E-03  9.371783E-03 -20.39407
 66             8.570474E-03 -3.20522E-03   9.150216E-03 -20.505
 67             8.30444E-03  -3.122818E-03  8.872188E-03 -20.60837
 68             7.987892E-03 -3.019309E-03  8.539476E-03 -20.70588
 69             7.622653E-03 -2.895379E-03  8.154021E-03 -20.79872
 70             7.210721E-03 -2.751749E-03  7.717941E-03 -20.88781
 71             6.754261E-03 -2.589181E-03  7.233526E-03 -20.97385
 72             6.255568E-03 -2.40848E-03   6.703201E-03 -21.05739
 73             5.717009E-03 -2.210471E-03  6.129468E-03 -21.1389
 74             5.140953E-03 -1.99598E-03   5.514829E-03 -21.21875
 75             4.529645E-03 -1.765785E-03  4.861654E-03 -21.29725
 76             3.885008E-03 -1.520538E-03  4.171968E-03 -21.37468
 77             3.208266E-03 -1.26062E-03   3.447047E-03 -21.45129
 78             2.499166E-03 -9.858254E-04  2.686574E-03 -21.52734
 79             1.753969E-03 -6.945587E-04  1.886484E-03 -21.60319
 80             9.595185E-04 -3.81449E-04   1.03256E-03  -21.6799
E               0              0              0              0
WIRE NO.: 4 MAGNITUDE =   .5343909 PHASE = -20.69132
 TOWER     MAGNITUDE   PHASE
 1  1  0
 2  1.960772  140.4001
 3  1.882334 -76.80001
 4  .882345  67.1003
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KRAK4N.OUT

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                    ****************************************
                    * Mini-Numerical Electromagnetics System *
                    *       CURRENTS - LU DECOMPOSITION II   *
                    *     07-09-2009          04:43:36       *
                    ****************************************
```

INPUT CONFIGURATION FILE: KRAK4.CON
NIGHT PATTERN DRIVE VALUES

********** ANTENNA GEOMETRY **********

DIMENSIONS ARE IN METERS.

WIRE NO. 1 COORDINATES X	Y	Z	RADIUS	CONNECTION END1	END2	PULSE NO.
0	0	0	0.2180E+00	-1	1	1
0	0	4.138	0.2180E+00	1	1	2
0	0	8.276	0.2180E+00	1	1	3
0	0	12.414	0.2180E+00	1	1	4
0	0	16.552	0.2180E+00	1	1	5
0	0	20.69	0.2180E+00	1	1	6
0	0	24.828	0.2180E+00	1	1	7
0	0	28.966	0.2180E+00	1	1	8
0	0	33.104	0.2180E+00	1	1	9
0	0	37.242	0.2180E+00	1	1	10
0	0	41.38	0.2180E+00	1	1	11
0	0	45.518	0.2180E+00	1	1	12
0	0	49.656	0.2180E+00	1	1	13
0	0	53.794	0.2180E+00	1	1	14
0	0	57.932	0.2180E+00	1	1	15
0	0	62.07	0.2180E+00	1	1	16
0	0	66.208	0.2180E+00	1	1	17
0	0	70.346	0.2180E+00	1	1	18
0	0	74.484	0.2180E+00	1	1	19
0	0	78.622	0.2180E+00	1	0	20

WIRE NO. 2 COORDINATES X	Y	Z	RADIUS	CONNECTION END1	END2	PULSE NO.
0	96.15	0	0.2180E+00	-2	2	21
0	96.15	4.138	0.2180E+00	2	2	22
0	96.15	8.276	0.2180E+00	2	2	23
0	96.15	12.414	0.2180E+00	2	2	24
0	96.15	16.552	0.2180E+00	2	2	25
0	96.15	20.69	0.2180E+00	2	2	26
0	96.15	24.828	0.2180E+00	2	2	27
0	96.15	28.966	0.2180E+00	2	2	28
0	96.15	33.104	0.2180E+00	2	2	29
0	96.15	37.242	0.2180E+00	2	2	30
0	96.15	41.38	0.2180E+00	2	2	31
0	96.15	45.518	0.2180E+00	2	2	32
0	96.15	49.656	0.2180E+00	2	2	33
0	96.15	53.794	0.2180E+00	2	2	34
0	96.15	57.932	0.2180E+00	2	2	35
0	96.15	62.07	0.2180E+00	2	2	36
0	96.15	66.208	0.2180E+00	2	2	37
0	96.15	70.346	0.2180E+00	2	2	38
0	96.15	74.484	0.2180E+00	2	2	39
0	96.15	78.622	0.2180E+00	2	0	40

WIRE NO. 3 COORDINATES X	Y	Z	RADIUS	CONNECTION END1	END2	PULSE NO.
0	192.3	0	0.2180E+00	-3	3	41
0	192.3	4.138	0.2180E+00	3	3	42
0	192.3	8.276	0.2180E+00	3	3	43
0	192.3	12.414	0.2180E+00	3	3	44
0	192.3	16.552	0.2180E+00	3	3	45
0	192.3	20.69	0.2180E+00	3	3	46
0	192.3	24.828	0.2180E+00	3	3	47
0	192.3	28.966	0.2180E+00	3	3	48
0	192.3	33.104	0.2180E+00	3	3	49
0	192.3	37.242	0.2180E+00	3	3	50
0	192.3	41.38	0.2180E+00	3	3	51
0	192.3	45.518	0.2180E+00	3	3	52
0	192.3	49.656	0.2180E+00	3	3	53
0	192.3	53.794	0.2180E+00	3	3	54
0	192.3	57.932	0.2180E+00	3	3	55
0	192.3	62.07	0.2180E+00	3	3	56

0	192.3	66.208	0.2180E+00	3	3	57
0	192.3	70.346	0.2180E+00	3	3	58
0	192.3	74.484	0.2180E+00	3	3	59
0	192.3	78.622	0.2180E+00	3	0	60

WIRE NO. 4 COORDINATES				CONNECTION		PULSE
X	Y	Z	RADIUS	END1	END2	NO.
0	288.46	0	0.2180E+00	-4	4	61
0	288.46	4.138	0.2180E+00	4	4	62
0	288.46	8.276	0.2180E+00	4	4	63
0	288.46	12.414	0.2180E+00	4	4	64
0	288.46	16.552	0.2180E+00	4	4	65
0	288.46	20.69	0.2180E+00	4	4	66
0	288.46	24.828	0.2180E+00	4	4	67
0	288.46	28.966	0.2180E+00	4	4	68
0	288.46	33.104	0.2180E+00	4	4	69
0	288.46	37.242	0.2180E+00	4	4	70
0	288.46	41.38	0.2180E+00	4	4	71
0	288.46	45.518	0.2180E+00	4	4	72
0	288.46	49.656	0.2180E+00	4	4	73
0	288.46	53.794	0.2180E+00	4	4	74
0	288.46	57.932	0.2180E+00	4	4	75
0	288.46	62.07	0.2180E+00	4	4	76
0	288.46	66.208	0.2180E+00	4	4	77
0	288.46	70.346	0.2180E+00	4	4	78
0	288.46	74.484	0.2180E+00	4	4	79
0	288.46	78.622	0.2180E+00	4	0	80

********** ENVIRONMENT **********

ENVIRONMENT HAS A GROUND PLANE.

********** FREQUENCY **********

FREQUENCY = .91 MHZ
WAVELENGTH = 329.4505 METERS

********** SOURCES **********

NO. OF SOURCES : 4
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES): 1 , 1 , 0
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES): 21 , 2.219095 ,-169.787
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES): 41 , 2.299365 , 50.072
PULSE NO., VOLTAGE MAGNITUDE, PHASE (DEGREES): 61 , 1.402301 ,-73.684

********** LOADING **********

NUMBER OF LOADS : 0

********** SOURCE SOLUTION **********

PULSE 1
VOLTAGE = (1 , 0 J)
CURRENT = (9.024733E-03 ,-2.912252E-02 J)
IMPEDANCE = (9.708535 , 31.32913 J)
POWER = 4.512366E-03

PULSE 21
VOLTAGE = (-2.183934 ,-.3934633 J)
CURRENT = (-2.515729E-02 , 4.027288E-02 J)
IMPEDANCE = (17.33904 , 43.39723 J)
POWER = 1.954798E-02

PULSE 41
VOLTAGE = (1.475789 , 1.763272 J)
CURRENT = (2.862615E-02 ,-.0193301 J)
IMPEDANCE = (6.840897 , 66.21593 J)
POWER = 4.080968E-03

PULSE 61
VOLTAGE = (.3939551 ,-1.345826 J)
CURRENT = (-1.524866E-02 , 1.925041E-03 J)
IMPEDANCE = (-36.39736 , 83.66369 J)
POWER = -4.29903E-03

TOTAL POWER = 2.384229E-02 WATTS

********** CURRENT SOLUTION **********

WIRE NO. 1 :

PULSE NO.	REAL (AMPS)	IMAGINARY (AMPS)	MAGNITUDE (AMPS)	PHASE (DEGREES)
1	9.024733E-03	-2.912252E-02	.0304888	-72.78239
2	8.998757E-03	-.0295103	3.085183E-02	-73.04164
3	8.920972E-03	-2.956193E-02	3.087866E-02	-73.20764
4	8.791815E-03	-2.939101E-02	.0306778	-73.34635
5	8.611997E-03	-2.901399E-02	3.026513E-02	-73.46794
6	8.382512E-03	-2.843973E-02	2.964937E-02	-73.5773
7	8.10462E-03	-2.767492E-02	2.883723E-02	-73.67729
8	7.779824E-03	-2.672577E-02	2.783509E-02	-73.76981
9	7.409866E-03	-2.559865E-02	2.664952E-02	-73.85622
10	6.996689E-03	-2.430031E-02	2.528752E-02	-73.93752
11	6.542408E-03	-2.283795E-02	2.375658E-02	-74.01453
12	6.049272E-03	-2.121913E-02	2.206456E-02	-74.0879
13	5.519609E-03	-1.945164E-02	.0202196	-74.15815
14	4.955745E-03	-1.754327E-02	1.822981E-02	-74.22571
15	4.359885E-03	-.0155014	1.610286E-02	-74.29097
16	3.733921E-03	-.0133323	.0138453	-74.35426
17	3.079078E-03	-1.103983E-02	1.146118E-02	-74.41588
18	2.395161E-03	-8.622724E-03	8.949199E-03	-74.47614
19	1.678648E-03	-6.067561E-03	6.295487E-03	-74.53539
20	9.170418E-04	-3.328058E-03	3.452092E-03	-74.59453
E	0	0	0	0

WIRE NO.: 1 MAGNITUDE = 1.740195 PHASE = -73.74136

WIRE NO. 2 :

PULSE NO.	REAL (AMPS)	IMAGINARY (AMPS)	MAGNITUDE (AMPS)	PHASE (DEGREES)
21	-2.515729E-02	4.027288E-02	4.748467E-02	121.9918
22	-2.527052E-02	4.118667E-02	4.832123E-02	121.5316
23	-2.517302E-02	4.149984E-02	.0485378	121.2402
24	-2.491014E-02	4.145942E-02	4.836733E-02	120.9988
25	-2.448941E-02	.0410995	4.784245E-02	120.7889
26	-2.391582E-02	4.043697E-02	4.697994E-02	120.6015
27	-2.319385E-02	3.948318E-02	4.579166E-02	120.4315
28	-2.232823E-02	3.824792E-02	.0442883	120.2754
29	-2.132404E-02	.0367407	4.248051E-02	120.1306
30	-2.018685E-02	3.497135E-02	4.037949E-02	119.9952
31	-1.892264E-02	3.295017E-02	3.799711E-02	119.8679
32	-1.753778E-02	3.068801E-02	3.534583E-02	119.7474
33	-.0160388	2.819597E-02	3.243849E-02	119.6326
34	-1.443227E-02	2.548517E-02	2.928795E-02	119.5229
35	-.0127244	2.256608E-02	2.590634E-02	119.4175
36	-1.092048E-02	1.944762E-02	2.230396E-02	119.3157
37	-9.023871E-03	1.613512E-02	1.848709E-02	119.2169
38	-7.033755E-03	1.262642E-02	1.445338E-02	119.1207
39	-4.939483E-03	8.901419E-03	1.018007E-02	119.0263
40	-2.703845E-03	4.891492E-03	5.589049E-03	118.9323
E	0	0	0	0

WIRE NO.: 2 MAGNITUDE = 2.766919 PHASE = 120.3288

WIRE NO. 3 :

PULSE NO.	REAL (AMPS)	IMAGINARY (AMPS)	MAGNITUDE (AMPS)	PHASE (DEGREES)
41	2.862615E-02	-.0193301	3.454141E-02	-34.02959
42	2.937499E-02	-1.997014E-02	3.552036E-02	-34.20923
43	2.966094E-02	-2.024926E-02	3.591384E-02	-34.32101
44	.0296833	-2.033406E-02	3.598016E-02	-34.41246
45	2.946927E-02	-2.024695E-02	.0357544	-34.49113
46	2.903208E-02	-.0199985	3.525339E-02	-34.56068
47	2.838041E-02	-1.959536E-02	3.448806E-02	-34.62329
48	.0275216	-.0190429	3.346745E-02	-34.68036
49	2.646261E-02	-.0183461	3.220014E-02	-34.73295
50	2.521059E-02	-1.750997E-02	3.069484E-02	-34.78183
51	2.377309E-02	-1.653972E-02	.0289607	-34.82761
52	2.215794E-02	-.0154408	2.700727E-02	-34.87079
53	2.037318E-02	-1.421876E-02	2.484431E-02	-34.91179
54	1.842687E-02	-1.287915E-02	2.248159E-02	-34.95097
55	1.632661E-02	-1.142719E-02	1.992835E-02	-34.98864
56	1.407887E-02	-9.86731E-03	1.719239E-02	-35.02507
57	1.168752E-02	-8.202102E-03	.0142784	-35.06052
58	9.150991E-03	-6.430299E-03	1.118434E-02	-35.09528
59	6.454695E-03	-4.541422E-03	7.892249E-03	-35.12962
60	3.548797E-03	-2.500079E-03	4.341008E-03	-35.16417

```
E               0              0              0              0
WIRE NO.: 3 MAGNITUDE =  2.088233 PHASE = -34.66126

WIRE NO.  4 :
PULSE          REAL           IMAGINARY      MAGNITUDE      PHASE
 NO.           (AMPS)         (AMPS)         (AMPS)         (DEGREES)
 61            -1.524866E-02  1.925041E-03   .0153697       172.8049
 62            -1.583926E-02  1.733748E-03   1.593386E-02   173.7533
 63            -1.611451E-02  1.598043E-03   1.619355E-02   174.3366
 64            -1.622621E-02  1.473797E-03   .016293        174.8102
 65            -1.619461E-02  1.355597E-03   1.625125E-02   175.2151
 66            -1.602907E-02  1.241409E-03   1.607707E-02   175.5714
 67            -1.573532E-02  1.130457E-03   1.577588E-02   175.8908
 68            -1.531782E-02  1.022516E-03   1.535191E-02   176.181
 69            -1.478061E-02  9.176366E-04   1.480907E-02   176.4474
 70            -1.412774E-02  8.160261E-04   1.415128E-02   176.6942
 71            -1.336337E-02  7.179797E-04   1.338264E-02   176.9246
 72            -1.249181E-02  6.238418E-04   1.250738E-02   177.141
 73            -.0115175      5.339787E-04   1.152987E-02   177.3455
 74            -1.044483E-02  4.487606E-04   1.045447E-02   177.5398
 75            -9.277956E-03  3.68545E-04    9.285272E-03   177.7253
 76            -8.020355E-03  2.936615E-04   8.02573E-03    177.9031
 77            -6.674036E-03  2.243923E-04   6.677807E-03   178.0743
 78            -5.237838E-03  1.609391E-04   5.24031E-03    178.2401
 79            -3.703079E-03  1.033458E-04   3.704521E-03   178.4014
 80            -2.040677E-03  5.12693E-05    2.041321E-03   178.5608
E               0              0              0              0
WIRE NO.: 4 MAGNITUDE =   .9571183 PHASE =  176.0884
 TOWER     MAGNITUDE    PHASE
 1  1  0
 2  1.590005  194.0701
 3  1.199999  39.0801
 4  .5500063  249.8298
```

Item 5

Summary of Post Construction Certified Array Geometry- KRAK

The tower relative distances and bearings are provided in feet on the Certified Survey drawing of Appendix A. The KRAK antenna system day and night patterns were previously licensed by a proof of performance conducted using the procedures of 47 CFR 73.151(a), and therefore a specific showing of as-built antenna tower locations is not required, per the Commission's Public Notice - 09-2340. However, inspection of Appendix A makes clear that the "as built" tower displacements from their specified locations expressed in electrical degrees at carrier frequency, which correspond to space phasing differences in the far-field radiation pattern of the array, are well below the +/- 3 degree operating phase range specified for antenna monitor parameters by the FCC Rules. One electrical degree at 910 kHz is 0.9151 meters, 3.002 feet.

Item 6

Sampling System Measurements - KRAK

Impedance measurements were made of the antenna monitor sampling system using a Power AIM 120 vector Impedance analyzer in a calibrated measurement system. The measurements were made looking into the antenna monitor ends of the sampling lines for two conditions – with and without the sampling lines connected to the sampling transformers at the towers.

The following table shows the frequency closest to the carrier frequency where resonance –zero reactance corresponding with low resistance – was found. As frequencies of resonance occur at odd multiples of 90 degrees electrical length, the sampling line length at the resonant frequency below carrier frequency – which is the closest one to the carrier frequency – was found to be 90 electrical degrees. The electrical length at carrier frequency appearing in the table below was calculated by ratioing the carrier frequency to the resonant frequency.

Tower	Sampling Line Open-Circuited Resonance (kHz)	Sampling Line Electrical Length at 910 kHz	910 kHz Measured Impedance with Sample Transformer Connected
1	1059.561	231.888°	52.95 -j1.19
2	1059.433	231.912°	52.52 -j1.37
3	1059.333	231.938°	53.26 -j1.89
4	1059.391	231.926°	53.147 -j1.27

The sampling line lengths meet the requirement that they be equal in length within 1 electrical degree.

The Delta Electronics toroidal current transformers for the towers were checked for compliance with the manufacturer's specifications, and found to be well within the stated tolerance.

Tower	Sample Transformer Type	Measured Relative Phase with Equal Currents Applied	Measured Relative Amplitude with Equal Currents Applied
1	TCT-1	0°	100.0
2	TCT-1	0°	100.0
3	TCT-1	0°	100.2
4	TCT-1	0°	100.0

In order to determine the characteristic impedance values of the sampling lines, open-circuited measurements were made with frequencies offset to produce +/- 45 degrees of electrical length from resonance. The characteristic impedance was calculated using the following formula, where R1 +j X1 and R2 +j X2 are the measured impedances at the +45 and –45 degree offset frequencies, respectively:

$$Zo = ((R_1^2 + X_1^2)^{1/2} \times (R_2^2 + X_2^2)^{1/2})^{1/2}$$

Tower	-45° Offset Frequency (kHz)	-45° Measured Impedance (Ohms)	+45° Offset Frequency (kHz)	+45° Measured Impedance (Ohms)	Calculated Characteristic Impedance (Ohms)
1	882.968	8.019 -J49.22	1236.155	11.466 +J48.162	49.69
2	882.861	7.934 -J48.609	1236.005	11.378 +J47.813	49.20
3	882.778	8.055 -J48.784	1235.889	11.583 +J47/786	49.31
4	882.826	8.092 -J48.949	1235.956	11.495 +J48.164	49.57

The sampling line measured characteristic impedances meet the requirement that they be equal within 2 ohms.

Item 7

Reference Field Strength Measurements - KRAK

Reference field strength measurements were made along radials at the azimuths with radiation values specified on the current license or the actual pattern minima) and, additionally, on the major lobe radials. Measurements were made using a Potomac Instruments field strength meter, model FIM-41, serial number 1323. This meter was last calibrated in 12/06/91, and has been routinely checked against other more recently calibrated instruments and found to be within the manufacturer's specifications.

The measured field strengths and descriptions and GPS coordinates for the reference measurement points are shown below:

Reference Point Measurements NAD 27 Datum

40° T Radial

Point 1
1.56 km from array center
34 23 57.6 N x 117 22 49.7 W
8170 Topaz Rd. On manhole cover, center of road
305 mV/m Day, 96 mV/m Night

Point 2
2.88 km from array center
34 24 30.2 N x 117 22 17.1 W
8120 Aberdeen Center of driveway at curb
162 mV/m Day, 48 mV/m Night

Point 3
4.39 km from array center
34 25 06.8 N x 117 21 37.8 W
13888 Senna @ Honeysuckle at fire hydrant
110 mV/m Day, 32.5mV/m Night

118.5° T Radial

Point 1
2.05 km from array center
34 22 47.6 N x 117 22 18.5 W
Escondido Ave & Crombie St NW corner
8.2 mV/m Day

Point 2
3.43 km from array center
34 22 27.4 N x 117 21 30.8 W
6840 Bandicoot Trail, water meter center of road
2.52 mV/m Day

Point 3
4.12 km from array center
34 22 13.7 N x 117 21 04.2 W
14333 Musgrave Rd between two poles at driveway
2.82 mV/m Day

120° Radial

Point 1
2.18 km from array center
34 22 44.8 N x 117 22 18.5 W
70 meters south of Cromdale on Escondido on water meter west side of road
10.7 mV/m Night

Point 2
3.04 km from array center
34 22 29.1 N x 117 21 46.6 W
6810 Fuente Ave by telco box #18045
3,25 mV/m Night

Point 3
4.03 km from array center
34 22 14.3 N x 117 21 12.5 W
On Musgrave 260 m west of Tamarisk Ave.
3.37 mV/m Night

151.5° Radial

Point 1
3.11 km from array center
34 21 50.3 N x 117 22 31.0 W
North side of Meadowlark Ave 340 m west of Escondido Ave
3.9 mV/m Day 11.3 mV.m Night

Point 2
2.48 km from array center
34 22 08.5 N x 117 22 43.7 W
12978 Whitehaven St Center of driveway at road edge
5.5 mV/m Day 14.0 mV/m Night

Point 3
1.55 km from array center
34 22 34.7 N x 117 23 0.2 W
Christina Rd South of Ranchero Rd 50 m North of Farmington on concrete
7.6 mV/m Day 27.7 mV/m Night

195.5° Radial

Point 1
2.11 km from array center
34 22 13/6 W x 117 23 53.3 W
Musgrave & Outpost Rd SW corner
3.9 mV/m Day

Point 2
3.56 km from array center
34 21 28 N x 117 24 08 W
Duxbury Rd. At Kouries Way NW corner at service road
1.18 mV/m Day

Point 3
4.39 km from array center
34 21 01.7 N x 117 24 15.5 W
On rural road at the above coordinates
2.28 mV/m Day

220° Radial

Point 1
0.95 km from array center
34 22 54.9 N x 117 23 53.3 W
On railroad track access road 160 m South of Ranchero Rd
490 mVm Night

Point 2
1.83 km from array center
34 22 33.5 N x 117 24 15.1 W
11854 Farmington St on water meter
270 mV/m Night

Point 3
5.69 km from array center
34 20 56.9 N x 117 25 52 W
By "Cable Route Warning" white post at coordinates above
74 mV/m Night

288.5° Radial

Point 1
1.58 km from array center
34 23 33.6 N x 117 24 25.7 W
Caliente Rd & Coriander Dr intersection middle of Caliente Rd
8.0 mVm Day 31 mV/m Night

Point 2
3.19 km from array center
34 23 51.2 N x 117 25 27.9 W
Verbana Road & Mesquite St NW corner at fire hydrant
1.28 mV/m Day 10.6 mV/m Night

Point 3
5,68 km from array center
34 24 16.2 N x 117 27 0.8 W
Baldy Mesa Rd & Cedar St NW corner by mailboxes
2.05 mV/m Day 3.92 mV/m Night

320° Radial

Point 1
1,57 km from array center
34 23 57.8 N x 117 24 9.3 W
8205 Caliente Rd center of driveway by bay #3 at truck repair facility
10.5 mV/m Night

Point 2
3.48 km from array center
34 24 43.8 N x 117 24 54.4 W
On Muscatel 110 meters east of Macron St @ telco box #17445
5.3 mV/m Night

Point 3
5,54 km from array center
34 25 36.4 N x 117 25 48.7 W
120 m East of Macron St on Northside Phelan Rd
3.5 mV/m Night

321.5° Radial

Point 1
1.62 km from array center
34 23 59.7 N x 117 24 9.3 W
8205 Caliente Rd @ fire hydrant by bay #5 of truck repair facility
5.3 mV/m Day

Point 2
3.33 km from array center
34 24 44.2 N x 117 24 50.1 W
Intersection of Muscatel & Grandview rd NE corner at fire hydrant
3.0 mV/m Day

Point 3
5.42 km from array center
34 25 36.6 N x 117 25 41.8 W
Phelan Rd at Daisy Rd by mailboxes 10722 Phelan Rd
1.65 mV/m Day

Item 8

Direct Measurement of Power - KRAK

Common point impedance measurements were made using a Power AIM 120 vector impedance analyzer calibrated measurement system. The measurements were made at the phasor cabinet input jack adjacent to the common point current meter that is used to determine operating power. The impedance measured at this point was adjusted to a value of 50 +/- j0 for both the daytime and nighttime antenna patterns.

Item 9

Antenna Monitor and Sampling System - KRAK

The antenna monitor is a Potomac Instruments model AM-19D (204). Delta TCT sample transformers are connected at the outputs of the four antenna tuning units.
The transformers are connected through equal length ½ inch foam insulated solid outer conductor sampling lines to the antenna monitor. The four sample lines are routed to the towers such that they are subject to similar environmental conditions.

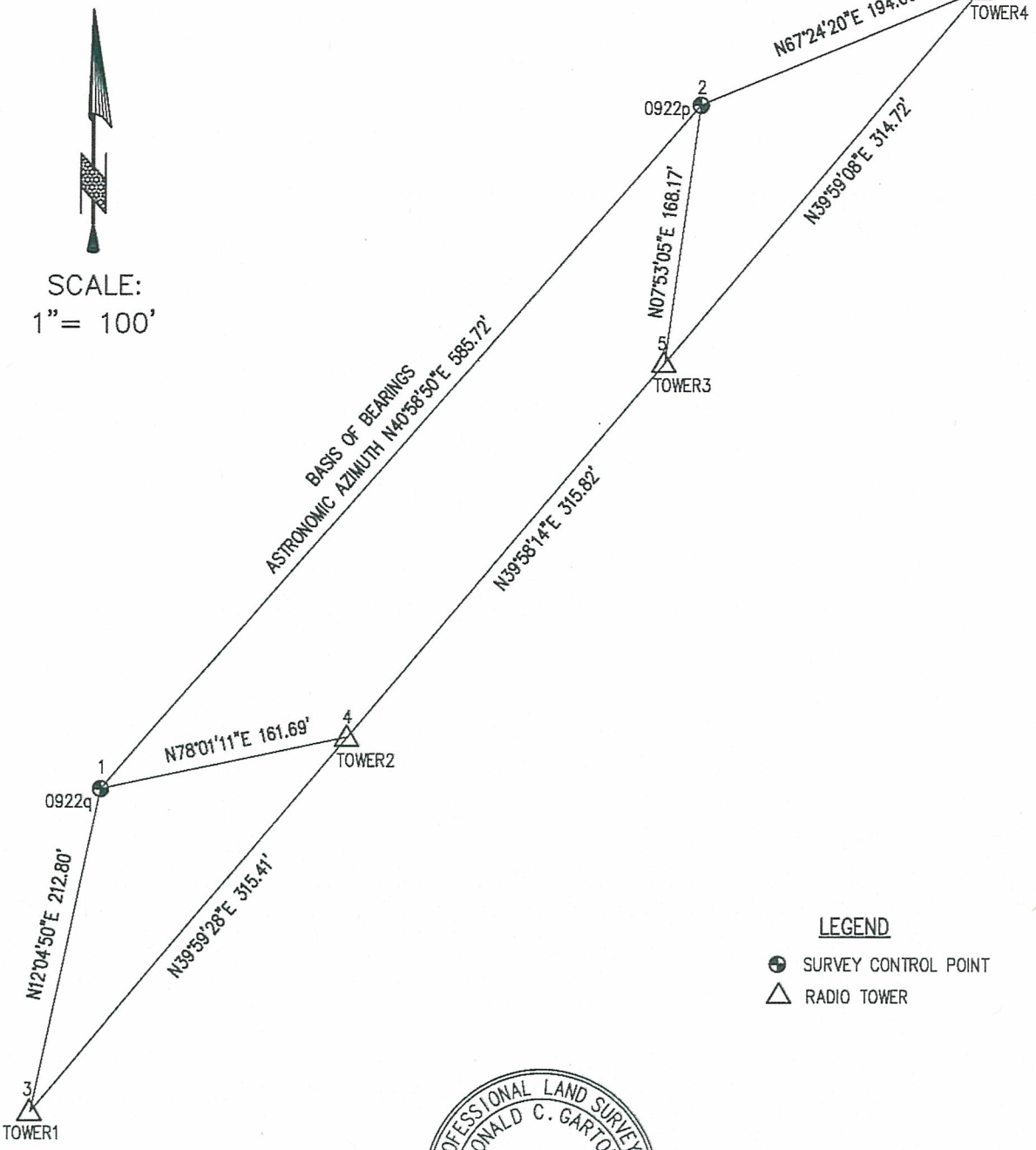
Appendix A

Certified Post Construction Array Geometry

SURVEY PLAT

SHEET 1 OF 1

KRAK RADIO TOWERS
OAK HILLS, CALIFORNIA



PROFESSIONAL LAND SURVEYOR
RONALD C. GARTON
No. 7717
Exp. 3/31/11
STATE OF CALIFORNIA

PREPARED BY:

9/24/09

RONALD C. GARTON, PLS 7717 DATE

CUBIT ENGINEERING INCORPORATED
16490 WALNUT STREET,UNIT B-3 HESPERIA, CA 92345
(760) 244-2247 cubitengineering.com

Appendix B

Station License BZ-19970723AC

(As modified 7/29/2008)

NOTE: This license document contains an evident incorrect power for the daytime operation. The original license application and the Commission engineering databases show that the authorized daytime power is 0.7 kW, with a consequent antenna input power of 0.7 x 1.08 = 760 watts. The license document data for common point current shows 3.9 amps, which is the correct value for 760 watt operation.

United States of America

FEDERAL COMMUNICATIONS COMMISSION

AM BROADCAST STATION LICENSE

Authorizing Official:

Official Mailing Address:

CBS RADIO STATIONS INC.
2175 K ST NW STE 350
WASHINGTON DC 20037

Susan N. Crawford
Assistant Chief
Audio Division
Media Bureau

Grant Date: September 30, 1997

This license expires 3:00 a.m. local time, December 01, 2013.

Facility Id: 72716

Call Sign: KRAK

License File Number: BZ-19970723AC

This authorization re-issued to correct tower registration numbers. 7/29/2008

Subject to the provisions of the Communications Act of 1934, subsequent acts and treaties, and all regulations heretofore or hereafter made by this Commission, and further subject to the conditions set forth in this license, the licensee is hereby authorized to use and operate the radio transmitting apparatus herein described.

This license is issued on the licensee's representation that the statements contained in licensee's application are true and that the undertakings therein contained so far as they are consistent herewith, will be carried out in good faith. The licensee shall, during the term of this license, render such broadcasting service as will serve the public interest, convenience, or necessity to the full extent of the privileges herein conferred.

This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequency designated in the license beyond the term hereof, nor in any other manner than authorized herein. Neither the license nor the right granted hereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934. This license is subject to the right of use or control by the Government of the United States conferred by Section 606 of the Communications Act of 1934.

Hours of Operation: Unlimited

Average hours of sunrise and sunset:
Local Standard Time (Non-Advanced)

Jan.	7:00 AM	5:00 PM	Jul.	4:45 AM	7:00 PM
Feb.	6:30 AM	5:30 PM	Aug.	5:15 AM	6:45 PM
Mar.	6:00 AM	6:00 PM	Sep.	5:30 AM	6:00 PM
Apr.	5:15 AM	6:15 PM	Oct.	6:00 AM	5:15 PM
May	4:45 AM	6:45 PM	Nov.	6:15 AM	4:45 PM
Jun	4:30 AM	7:00 PM	Dec	6:45 AM	4:45 PM

Name of Licensee: CBS RADIO STATIONS INC.

Station Location: HESPERIA, CA

Frequency (kHz): 910

Station Class: B

Antenna Coordinates:

	Day					
Latitude:	N	34	Deg	23	Min	19 Sec
Longitude:	W	117	Deg	23	Min	29 Sec

Transmitter(s): Type Accepted. See Sections 73.1660, 73.1665 and 73.1670 of the Commission's Rules.

Nominal Power (kW): Day: 0.68 Night: 0.50

Antenna Input Power (kW): Day: 0.75 Night: 0.54

Antenna Mode: Day: DA Night: DA

(DA=Directional Antenna, ND=Non-directional Antenna; CH=Critical Hours)

Current (amperes): Day: 3.9 Night: 3.3

Resistance (ohms): Day: 50 Night: 50

Antenna Registration Number(s):

Day:

Tower No.	ASRN	Overall Height (m)
1	1028582	
2	1028754	
3	1028755	
4	1028756	

Night:

Tower No.	ASRN	Overall Height (m)
1	1028582	
2	1028754	
3	1028755	
4	1028756	

Callsign: KRAK License No.: BZ-19970723AC

DESCRIPTION OF DIRECTIONAL ANTENNA SYSTEM

Theoretical RMS (mV/m/km): Day: 289.64 Night: 247.05

Standard RMS (mV/m/km): Night: 259.66

Augmented RMS (mV/m/km): Day: 304.44

Q Factor: Day: 10.11 Night: 10.95

Theoretical Parameters:

Day Directional Antenna:

Tower No.	Field Ratio	Phasing (Deg.)	Spacing (Deg.)	Orientation (Deg.)	Tower Ref Switch *	Height (Deg.)
1	0.5100	-140.400	0.0000	0.000	0	86.5
2	1.0000	0.000	105.0000	220.000	0	86.5
3	0.9600	142.800	210.0000	220.000	0	86.5
4	0.4500	-73.300	315.0000	220.000	0	86.5

* Tower Reference Switch
0 = Spacing and orientation from reference tower
1 = Spacing and orientation from previous tower

Augmentation Parameters:

Aug No.	Central Azimuth (Deg. T)	Span (Deg.)	Radiation at Central Azimuth (mV/m @ 1 km)
1	195.5	30.0	18.00
2	244.5	30.0	25.00
3	288.5	30.0	25.00
4	320.0	30.0	36.00

Theoretical Parameters:

Night Directional Antenna:

Tower No.	Field Ratio	Phasing (Deg.)	Spacing (Deg.)	Orientation (Deg.)	Tower Ref Switch *	Height (Deg.)
1	1.0000	0.000	0.0000	0.000	0	86.5
2	1.5900	194.070	105.0000	220.000	0	86.5
3	1.2000	39.080	210.0000	220.000	0	86.5
4	0.5500	249.830	315.0000	220.000	0	86.5

* Tower Reference Switch
0 = Spacing and orientation from reference tower
1 = Spacing and orientation from previous tower

Day Directional Operation:

Twr. No.	Phase (Deg.)	Antenna Monitor Sample Current Ratio
1	-141.1	0.485
2	0	1
3	142.6	0.99

Day Directional Operation:

Twr. No.	Phase (Deg.)	Antenna Monitor Sample Current Ratio
4	-74	0.476

Night Directional Operation:

Twr. No.	Phase (Deg.)	Antenna Monitor Sample Current Ratio
1	164.5	0.638
2	0	1
3	-155.8	0.735
4	52.3	0.33

Antenna Monitor: POTOMAC INSTRUMENTS AM-19D (204)

Sampling System Approved Under Section 73.68 of the Rules.

Monitoring Points:

Day Operation:

Radial (Deg. T)	Distance From Transmitter (kM)	Maximum Field Strength (mV/m)
120	1.6	
151.5	4.8	
288.5	3.2	
320	6.4	

Night Operation:

Radial (Deg. T)	Distance From Transmitter (kM)	Maximum Field Strength (mV/m)
120	1.6	
151.5	4.8	
288.5	3.2	
320	6.4	

Special operating conditions or restrictions:

1 MONITOR POINT DESCRIPTIONS

120° - From intersection of Ranchero and Foley Road, proceed south for 500 feet to intersection of Foley and dirt road entrance to ranch on west side of Foley, 1.6 km from site, max 8.5 mV/m daytime, max 12.2 mV/m nighttime.

151.5° - From intersection of Summit Valley Road and Agate Road, proceed left onto Agate Road for 0.56 km to stone wall gate, 4.81 km from site, max 4.0 mV/m daytime, max 7.1 mV/m nighttime.

288.5° - Point located at dirt road intersection of Verbena and Mesquite Street, 3.2 km from site, max 2.2 mV/m daytime, max 12.5 mV/m nighttime.

320° - From intersection of Phelan Road and Rose Drive, proceed north to 10051 Rose Drive, 6.4 km from site, max 4.8 mV/m daytime, max 5.3 mV/m nighttime.

*** END OF AUTHORIZATION ***

ORIGINAL

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant

CBS RADIO STATIONS, INC.

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

[X] Station License [ ] Direct Measurement of Power

1. Facilities authorized in construction permit

Call Sign	File No. of Construction Permit (if applicable)	Frequency (kHz)	Hours of Operation	Power in kilowatts	
				Night	Day
KRAK	NOT APPLICABLE	910 KHZ	UNLIMITED	0.50	0.70

2. Station location

State	City or Town
CALIFORNIA	HESPERIA

3. Transmitter location

State	County	City or Town	Street address (or other identification)
CA	SAN BERNARDINO	HESPERIA	7600 MESA LINDA ROAD

4. Main studio location

State	County	City or Town	Street address (or other identification)
CA	SAN BERNARDINO	HESPERIA	11920 HESPERIA RD.

5. Remote control point location (specify only if authorized directional antenna)

State	County	City or Town	Street address (or other identification)
CA	SN BERNARDINO	HESPERIA	11920 HESPERIA RD.

6. Has type-approved stereo generating equipment been installed? [ ] Yes [X] No

7. Does the sampling system meet the requirements of 47 C.F.R. Section 73.68? [X] Yes [ ] No [ ] Not Applicable

Attach as an Exhibit a detailed description of the sampling system as installed. Exhibit No. ENG. RPT.

8. Operating constants:

RF common point or antenna current (in amperes) without modulation for night system	RF common point or antenna current (in amperes) without modulation for day system
3.29 AMPS	3.89 AMPS
Measured antenna or common point resistance (in ohms) at operating frequency Night: 50.0 Day: 50.0	Measured antenna or common point reactance (in ohms) at operating frequency Night: +/-0 Day: +/-0

Antenna indications for directional operation

Towers	Antenna monitor Phase reading(s) in degrees		Antenna monitor sample current ratio(s)		Antenna base currents	
	Night	Day	Night	Day	Night	Day
1	164.7	-143.0	0.654	0.472	NOT	NOT
2	0	0	1.00	1.00	REQUIRED	REQUIRED
3	-156.6	142.0	0.729	1.028		
4	49.0	-75.2	0.322	0.505		

Manufacturer and type of antenna monitor: POTOMAC INSTRUMENTS AM19D (204)

SECTION III - Page 2

9. Description of antenna system ((f directional antenna is used, the information requested below should be given for each element of the array. Use separate sheets if necessary.)

Type Radiator	Overall height in meters of radiator above base insulator, or above base, if grounded.	Overall height in meters above ground (without obstruction lighting)	Overall height in meters above ground (include obstruction lighting)	If antenna is either top loaded or sectionalized, describe fully in an Exhibit.
UNIFORM CROSS SECTION GUYED TOWERS ASR 1028582,1028754 1028755,1028756	ALL 79.2	ALL 81.0	ALL 81.0	Exhibit No. DNA

Excitation [X] Series [ ] Shunt

Geographic coordinates to nearest second. For directional antenna give coordinates of center of array. For single vertical radiator give tower location.

North Latitude				West Longitude			
	34 °	23 '	19 "		117 °	23 '	29 "

If not fully described above, attach as an Exhibit further details and dimensions including any other antenna mounted on tower and associated isolation circuits. Exhibit No. DNA

Also, if necessary for a complete description, attach as an Exhibit a sketch of the details and dimensions of ground system. Exhibit No. DNA

10. In what respect, if any, does the apparatus constructed differ from that described in the application for construction permit or in the permit?

NO NEW CONSTRUCTION

11. Give reasons for the change in antenna or common point resistance.

NO CHANGE - Moment Method Proof of Performance per 47CFR73.151(c)

I certify that I represent the applicant in the capacity indicated below and that I have examined the foregoing statement of technical information and that it is true to the best of my knowledge and belief.

Name (Please Print or Type)	Signature (check appropriate box below)
BENJ. F. DAWSON III, P.E.	
Address (include ZIP Code) HATFIELD & DAWSON CONSULTING ENGINEERS 9500 GREENWOOD AVENUE NORTH SEATTLE, WA 98103 USA	Date November 9, 2009 Telephone No. (Include Area Code) (206) 783 9151

[ ] Technical Director [X] Registered Professional Engineer

[ ] Chief Operator [X] Consulting Engineer

[ ] Other (specify)