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January 31, 2014

Marlene H. Dortch, Secretary
Federal Communications Commission
Office of the Secretary
445 12th Street, SW
Room TW-A325
Washington, DC 20554

--VIA HAND DELIVERY--

ATTN: Audio Division, Media Bureau

Re: Advanced Modulation Broadcasting, LLC
KDCO(AM), Golden, CO (Facility ID No. 161314)
FCC Form 302-AM, License to Cover
File No.: BMP-20130219AAQ

Dear Ms. Dortch:

Enclosed for filing please find an original and two copies of FCC Form 302-AM license application, submitted on behalf of Advanced Modulation Broadcasting, LLC, for broadcast station KDCO(AM), Golden, CO. Form 159 will be electronically submitted with payment.

Please direct any questions to the undersigned.

Respectfully submitted,

ADVANCED MODULATION BROADCASTING, LLC

By: _____
A. Wray Fitch III

Enclosures (as stated)

cc: Vic Michael (via email with enclosures)

SECTION II - APPLICANT INFORMATION		
1. NAME OF APPLICANT Advanced Modulation Broadcasting, LLC		
MAILING ADDRESS 87 Jasper Lake Road		
CITY Loveland, CO	STATE Colorado	ZIP CODE 80537

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
KDCO	GOLDEN	BNP-20100216ABH	BMP-20130219AAQ	02/02/2014

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. 1

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?

☐ Yes ☑ No

If Yes, explain in an Exhibit.

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	
Victor A Michael, Jr.		
Title	Date	Telephone Number
Sole Member	01/31/2014	970-669-9200

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.

EXHBIT 1
KDCO GOLDEN, CO
ADVANCED MODULATION BROADCASTING, LLC
FCC FORM 302-AM
JANUARY 2014

Automatic Program Test Authority has not yet commenced due to the Special Operating Conditions or Restrictions #2 as listed on the Construction Permit (BMP-20130219AAQ). It states: "The permittee must submit a proof of performance as set forth in either Section 73.151(a) or 73.151(c) of the rules before program test are authorized".

KDCO will begin Program Tests as soon as it is authorized to do so.

SECTION III - LICENSE APPLICATION ENGINEERING DATA

Name of Applicant
ADVANCED MODULATION BROADCASTING, L.L.C.

PURPOSE OF AUTHORIZATION APPLIED FOR: (check one)

☑ 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
KDCO	BMP20130219AAQ	1550	UNLIMITED	0.35	0.99

2. Station location	
State	City or Town
COLORADO	Golden

3. Transmitter location			
State	County	City or Town	Street address (or other identification)
CO	Jefferson	Golden	

4. Main studio location			
State	County	City or Town	Street address (or other identification)
CO			TBD

5. Remote control point location (specify only if authorized directional antenna)			
State	County	City or Town	Street address (or other identification)

6. Has type-approved stereo generating equipment been installed? ☐ Yes ☑ No

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

Attach as an Exhibit a detailed description of the sampling system as installed. Exhibit No. see eng stmt

8. Operating constants:	
RF common point or antenna current (in amperes) without modulation for night system 2.75A	RF common point or antenna current (in amperes) without modulation for day system 4.59A
Measured antenna or common point resistance (in ohms) at operating frequency Night 50 Day 47	Measured antenna or common point reactance (in ohms) at operating frequency Night 0 Day +j26.3

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(W)	0.0 ref		1.000 ref			
2(E)	+22.0		0.773			

Manufacturer and type of antenna monitor: POTOMAC INSTRUMENTS AM19 type 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.
GUYED TOWER	SEE ENG STMT	SEE ENG STMT	SEE ENG STMT	Exhibit No.

Excitation ☑ 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	39 °	53 '	31 "	West Longitude	105 °	14 '	20 "

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.

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

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

none

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

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)
Timothy C. Cutforth	Timothy C Cutforth
Address (include ZIP Code)	Date
BROADCAST ENGINEERING CONSUL 965 S. IRVING STREET DENVER, CO 80219	01/30/2014
	Telephone No. (Include Area Code) 303-937-1900

☐ Technical Director ☑ Registered Professional Engineer

☐ Chief Operator ☐ Technical Consultant

☐ Other (specify)

EXHIBIT E-1

APPLICATION FOR LICENSE INFORMATION
RADIO STATION KDCO
GOLDEN, COLORADO

Advanced Modulation Broadcasting, LLC

January 30, 2014

1550 kHz 0.99 kW-D/0.35 kW-N DA-N

EXECUTIVE SUMMARY

This engineering exhibit supports an application for license for the new nighttime directional antenna system of radio station KDCO in Brighton, Colorado (FCC FID No. 161314) pursuant to the recently enacted AM technical rules permitting moment-method modeling of eligible AM directional arrays.

KDCO is a new station authorized to operate on 1550 kHz with non-directional antenna daytime and a power of 0.99kW and directional antenna nighttime with a power of 0.35kW BMP 20130219AAQ. The instant application requests license and program test authority based on Method of Moments certification of the facility.

Information is provided herein showing that the directional antenna parameters the daytime pattern authorized by the FCC have been determined in accordance with the requirements of 47 C.F.R. §73.151(c). The system has been preset to values computed to produce antenna monitor parameters within ±5 percent in ratio and ±3 degrees in phase of the modeled values, as required by the Rules. A station license is requested herewith specifying the nighttime operating parameters.

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 Delta OIB-1operating impedance bridge. The other tower was open-circuited at the same point where the impedance measurements were made for them. The static drain chokes at the ATU outputs are located on the ATU side of the antenna sample and are disconnected from all towers when the J-plugs are removed for measurements. This arrangement left only the short feed tubing between the ATU outputs and the tower base in series in the impedance measurements.

ACSModel (MININEC 3.1 core) was used to model the KDCO array.

A lumped load with a reactance of –j10,000 Ohms was modeled at the base of the other tower to simulate an open circuit at each tower base.

The tower heights were adjusted in the model in order to achieve calibration of the model with the measured base impedances. All modeled tower heights were within 75 to 125 percent of the physical tower height as required by the FCC Rules.

The modeled radius for each tower was near the physical radius of the tower as determined by the formula $3T/2\pi$, where T is the tower face width in meters. The KDCO radiators are uniform cross-section triangular towers and have face widths of 0.4256 meters resulting in an apparent radius of 0.2032 meter. The tower's radius was modeled at 0.2033 meter for tower 1 and 0.3040 meter for tower 2 within the allowable range of modeled radius to best fit the tower measured impedance characteristic.

Each tower is fed with a short length of large-diameter copper tubing that exhibits a small amount of series inductive reactance. This tubing connects to each tower immediately above the base insulator.

The two towers had slightly different impedances likely due to a 1 ft difference in the tower base pier height and a very short ground lead from the tower base from the ATU for tower 1. The ground contour around the base of the tower is also slightly different. This results in a higher measured base resistance than the other tower. The ATU is also lower and situated very close to the tower base, resulting in a lower series inductance. The model calibration process was able to compensate for these differences well within the allowable tolerances specified in the rules.

A circuit model was constructed for each tower using the assumed series feed tubing and shunt base region reactances. This model was used with the Westberg Circuit Analysis Program (WCAP) to determine the effects of these reactances on the ATU output impedance at each tower. In each of the WCAP tabulations, node 2 represents the ATU output reference point and node 3 represents the tower base. Node 0 represents ground potential. The ATU output impedances can be found in the "TO NODE IMPEDANCE" column of each WCAP tabulation, following the phantom 1.0 ohm resistor inserted in the model to provide a calculation point for the impedance. The complex base impedance of each tower from the moment method model is represented in each case by the complex load from node 3 to ground. A value of 80 pF was assumed for the base insulator, and this appears in the WCAP

tabulation from node 3 to ground as 0.001 (microfarads) due to rounding. The WCAP circuit model tabulation immediately follows the model for each tower.

§73.151(c)(1)(vii) permits the use of a lumped series inductance of 10 uH or less between the output port of each antenna tuning unit and the associated tower. In each case, the value of lumped series inductance was below this 10 uH limit.

The modeled and measured impedances at the ATU output J-plugs with the other tower open-circuited at their ATU output J-plugs agree within ±2 ohms and ±4 percent as required by the FCC rules.

Table 1 – Analysis of Tower Impedance Measurements to Verify Moment Method Model

Twr.	Z_{BASE} (Modeled)	Z_{ATU} (Modeled)	Z_{ATU} (Measured)	Series L (uH)	Shunt C pF	Phys. Height (deg.)	Model Height (deg.)	% Phys. Height
1 (W)	43.1+j19.2	44.5+j26.3	47.0 +j26.3	0.87	80	85.0	89.5	105.3
2 (E)	42.3 –j18.9	43.6+j32.5	44.0 +j32.5	1.53	80	85.0	89.5	105.3

```
****************************************
                ACSModel
           (MININEC 3.1 Core)
      01-30-2014          09:41:38
****************************************

kdco
mom west tower 1
calibration run

Frequency = 1.550 MHz      Wavelength = 193.41936 Meters

No. of Wires: 2
```

Wire No. 1 Coordinates X	Y	Z	Radius	End Connection	No. of Segments
0	0	0		-1	
0	0	48.0862	0.304	0	20

Wire No. 2 Coordinates X	Y	Z	Radius	End Connection	No. of Segments
-22.15771	105.1459	0		-2	
-22.15771	105.1459	48.0862	0.2033	0	20

**** ANTENNA GEOMETRY ****

Wire No. 1 Coordinates X	Y	Z	Radius	Connection End1	End2	Pulse No.
0	0	0	0.304	-1	1	1
0	0	2.40431	0.304	1	1	2
0	0	4.80862	0.304	1	1	3
0	0	7.21293	0.304	1	1	4
0	0	9.61724	0.304	1	1	5
0	0	12.02155	0.304	1	1	6
0	0	14.42586	0.304	1	1	7
0	0	16.83017	0.304	1	1	8
0	0	19.23448	0.304	1	1	9
0	0	21.63879	0.304	1	1	10
0	0	24.0431	0.304	1	1	11
0	0	26.44741	0.304	1	1	12
0	0	28.85172	0.304	1	1	13
0	0	31.25603	0.304	1	1	14
0	0	33.66034	0.304	1	1	15
0	0	36.06465	0.304	1	1	16
0	0	38.46896	0.304	1	1	17
0	0	40.87327	0.304	1	1	18
0	0	43.27758	0.304	1	1	19
0	0	45.68189	0.304	1	0	20

Wire No. 2 Coordinates				Connection		Pulse
X	Y	Z	Radius	End1	End2	No.
-22.15771	105.1459	0	0.2033	-2	2	21
-22.15771	105.1459	2.40431	0.2033	2	2	22
-22.15771	105.1459	4.80862	0.2033	2	2	23
-22.15771	105.1459	7.21293	0.2033	2	2	24
-22.15771	105.1459	9.61724	0.2033	2	2	25
-22.15771	105.1459	12.02155	0.2033	2	2	26
-22.15771	105.1459	14.42586	0.2033	2	2	27
-22.15771	105.1459	16.83017	0.2033	2	2	28
-22.15771	105.1459	19.23448	0.2033	2	2	29
-22.15771	105.1459	21.63879	0.2033	2	2	30
-22.15771	105.1459	24.0431	0.2033	2	2	31
-22.15771	105.1459	26.44741	0.2033	2	2	32
-22.15771	105.1459	28.85172	0.2033	2	2	33
-22.15771	105.1459	31.25603	0.2033	2	2	34
-22.15771	105.1459	33.66034	0.2033	2	2	35
-22.15771	105.1459	36.06465	0.2033	2	2	36
-22.15771	105.1459	38.46896	0.2033	2	2	37
-22.15771	105.1459	40.87327	0.2033	2	2	38
-22.15771	105.1459	43.27758	0.2033	2	2	39
-22.15771	105.1459	45.68189	0.2033	2	0	40

```
Sources:  1
Pulse No., Voltage Magnitude, Phase (Degrees): 1, 1000.0, 0.0

Number of Loads:  1
Pulse No., Resistance, Reactance:  21 , 0 ,-10000

********************    SOURCE DATA     ********************
Pulse  1      Voltage = (1000.0, 0.0j)
              Current = (19.3785, -8.6361j)
              Impedance = (43.053, 19.187j)
              Power = 9689.23 Watts
```

```
WESTBERG CIRCUIT ANALYSIS PROGRAM


 FILE NAME = kdco-1.cir

 I      1.0000     0     1      .0000      .0000      .0000
 R      1.0000     1     2      .0000      .0000      .0000
 L       .8700     2     3      .0000      .0000      .0000
 C       .0001     3     0      .0000      .0000      .0000
 R     43.0530     3     0    19.1870      .0000      .0000
 EX      .0000     0     0      .0000      .0000      .0000


 FREQ = 1.550

   NODE       VOLT MAG      VOLT PHASE
    1         52.5213         30.0258
    2         51.6579         30.5808
    3         47.9059         21.8226
                          BRANCH VOLTAGE       BRANCH CURRENT FROM NODE IMPEDANCE  TO NODE IMPEDANCE
                          MAG      PHASE       MAG      PHASE RESISTANCE REACTANCE RESISTANCE REACTANCE
VSWR
 R     1-  2      1.000      1.00      .000      1.00      .000     45.47     26.28     44.47     26.28
 L     2-  3       .870      8.47    90.000      1.00      .000     44.47     26.28     44.47     17.81
 C     3-  0       .000     47.91    21.823       .04   111.823       .00  -1140.90       .00       .00
 R     3-  0    43.053      47.91    21.823      1.02    -2.198     43.05     19.19       .00       .00



Copy of file  KDCO-1.CIR

1.550 0. 1
I 1 0 1
R 1.000 1 2
L 0.87 2 3
C .00008 3 0
R 43.053 3 0 +19.187
EX
```

```
                    ****************************************
                                ACSModel
                             (MININEC 3.1 Core)
                          01-30-2014              09:51:43
                    ****************************************

kdco
mom east tower 2
calibration run

Frequency = 1.550 MHz     Wavelength = 193.41936 Meters

No. of Wires: 2

Wire No. 1   Coordinates                                  End          No. of
   X             Y             Z          Radius     Connection
Segments
 0             0             0                          -1
 0             0             48.0862       0.304         0              20

Wire No. 2   Coordinates                                  End          No. of
   X             Y             Z          Radius     Connection
Segments
-22.15771      105.1459      0                          -2
-22.15771      105.1459      48.0862       0.2033        0              20

                  **** ANTENNA GEOMETRY ****

Wire No.  1  Coordinates                                  Connection Pulse
X             Y             Z             Radius        End1 End2  No.
 0             0             0             0.304         -1   1     1
 0             0             2.40431       0.304         1    1     2
 0             0             4.80862       0.304         1    1     3
 0             0             7.21293       0.304         1    1     4
 0             0             9.61724       0.304         1    1     5
 0             0             12.02155      0.304         1    1     6
 0             0             14.42586      0.304         1    1     7
 0             0             16.83017      0.304         1    1     8
 0             0             19.23448      0.304         1    1     9
 0             0             21.63879      0.304         1    1     10
 0             0             24.0431       0.304         1    1     11
 0             0             26.44741      0.304         1    1     12
 0             0             28.85172      0.304         1    1     13
 0             0             31.25603      0.304         1    1     14
 0             0             33.66034      0.304         1    1     15
 0             0             36.06465      0.304         1    1     16
 0             0             38.46896      0.304         1    1     17
 0             0             40.87327      0.304         1    1     18
 0             0             43.27758      0.304         1    1     19
 0             0             45.68189      0.304         1    0     20
```

Wire No. 2 Coordinates				Connection		Pulse
X	Y	Z	Radius	End1	End2	No.
-22.15771	105.1459	0	0.2033	-2	2	21
-22.15771	105.1459	2.40431	0.2033	2	2	22
-22.15771	105.1459	4.80862	0.2033	2	2	23
-22.15771	105.1459	7.21293	0.2033	2	2	24
-22.15771	105.1459	9.61724	0.2033	2	2	25
-22.15771	105.1459	12.02155	0.2033	2	2	26
-22.15771	105.1459	14.42586	0.2033	2	2	27
-22.15771	105.1459	16.83017	0.2033	2	2	28
-22.15771	105.1459	19.23448	0.2033	2	2	29
-22.15771	105.1459	21.63879	0.2033	2	2	30
-22.15771	105.1459	24.0431	0.2033	2	2	31
-22.15771	105.1459	26.44741	0.2033	2	2	32
-22.15771	105.1459	28.85172	0.2033	2	2	33
-22.15771	105.1459	31.25603	0.2033	2	2	34
-22.15771	105.1459	33.66034	0.2033	2	2	35
-22.15771	105.1459	36.06465	0.2033	2	2	36
-22.15771	105.1459	38.46896	0.2033	2	2	37
-22.15771	105.1459	40.87327	0.2033	2	2	38
-22.15771	105.1459	43.27758	0.2033	2	2	39
-22.15771	105.1459	45.68189	0.2033	2	0	40

```
Sources:  1
Pulse No., Voltage Magnitude, Phase (Degrees): 21, 1000.0, 0.0

Number of Loads:  1
Pulse No., Resistance, Reactance:  1 , 0 ,-10000

********************    SOURCE DATA     ********************
Pulse  21     Voltage = (1000.0, 0.0j)
              Current = (19.7087, -8.8281j)
              Impedance = (42.26, 18.929j)
              Power = 9854.34 Watts
```

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = kdco-2.cir

I	1.0000	0	1	.0000	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	1.5300	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	42.2600	3	0	18.9290	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.550

NODE	VOLT MAG	VOLT PHASE
1	55.1875	36.2845
2	54.3847	36.9079
3	46.9726	22.2144

				BRANCH VOLTAGE		BRANCH CURRENT	FROM NODE IMPEDANCE		TO NODE IMPEDANCE	
				MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
VSWR											
R	1-	2	1.000	1.00	.000	1.00	.000	44.49	32.66	43.49	32.66
L	2-	3	1.530	14.90	90.000	1.00	.000	43.49	32.66	43.49	17.76
C	3-	0	.000	46.97	22.214	.04	112.214	.00	-1283.51	.00	.00
R	3-	0	42.260	46.97	22.214	1.01	-1.914	42.26	18.93	.00	.00

Copy of file KDCO-2.cir

```
1.550 0. 1
I 1 0 1
R 1.0000 1 2
L 1.53 2 3
C .00008 3 0
R 42.26 3 0 +18.929
EX
```

Once calibrated against the measured individual open-circuited base impedances, the moment method model was utilized for nighttime directional antenna calculations. These calculations were made to determine the complex voltage source values to be applied at ground level for each tower of the array to produce the current moment sums for the towers which, when normalized to the reference tower, equate to the theoretical field parameters of the authorized directional pattern. These voltage sources were then applied in the model and the tower currents were calculated.

Twenty segments were used for each tower. The KDCO towers are base sampled, which is permitted for towers of 120 electrical degrees or less. As such, the first (ground) segment of each tower was used to determine the model operating parameters of the array.

A circuit model was constructed to determine the effect of the series feed inductance, and shunt base region capacitance on the ATU output current. The circuit model for each tower is essentially the circuit model used for model verification above using the model-predicted operating impedance for each tower. Again, this model was used with the Westberg Circuit Analysis Program (WCAP).

This effect was, as expected, minimal, and the results are tabulated in the table below along with the base operating parameters for the daytime array.

Twr.	Node	Current Magnitude (amperes)	Base Current Ratios	Current Phase (degrees)	WCAP Current Offset for Unity I_{BASE}	WCAP Phase Offset for Unity $Ø_{BASE}$ (degrees)	Antenna Monitor Ratio	Antenna Monitor Phase (degrees)
1 W	1	3.766	1.000	+4.72	1.005	+1.64	1.000	0.0
2 E	21	2.931	0.778	+26.97	1.010	+0.95	0.773	+22.0

```
****************************************
                ACSModel
          (MININEC 3.1 Core)
      01-30-2014          10:03:12
****************************************

kdco
mom directional
parameters determinationation

Frequency = 1.550 MHz     Wavelength = 193.41936 Meters

No. of Wires: 2

Wire No. 1   Coordinates                              End          No. of
   X             Y             Z          Radius     Connection
Segments
 0             0             0                        -1
 0             0             48.0862       0.304       0              20

Wire No. 2   Coordinates                              End          No. of
   X             Y             Z          Radius     Connection
Segments
-22.15771      105.1459      0                        -2
-22.15771      105.1459      48.0862       0.2033      0              20

                **** ANTENNA GEOMETRY ****

Wire No.  1  Coordinates                                Connection  Pulse
X             Y             Z          Radius          End1 End2   No.
 0             0             0          0.304          -1   1      1
 0             0             2.40431    0.304          1    1      2
 0             0             4.80862    0.304          1    1      3
 0             0             7.21293    0.304          1    1      4
 0             0             9.61724    0.304          1    1      5
 0             0             12.02155   0.304          1    1      6
 0             0             14.42586   0.304          1    1      7
 0             0             16.83017   0.304          1    1      8
 0             0             19.23448   0.304          1    1      9
 0             0             21.63879   0.304          1    1      10
 0             0             24.0431    0.304          1    1      11
 0             0             26.44741   0.304          1    1      12
 0             0             28.85172   0.304          1    1      13
 0             0             31.25603   0.304          1    1      14
 0             0             33.66034   0.304          1    1      15
 0             0             36.06465   0.304          1    1      16
 0             0             38.46896   0.304          1    1      17
 0             0             40.87327   0.304          1    1      18
 0             0             43.27758   0.304          1    1      19
 0             0             45.68189   0.304          1    0      20
```

```
Wire No.  2  Coordinates                                    Connection Pulse
X             Y             Z             Radius          End1 End2  No.
-22.15771      105.1459      0             0.2033          -2   2     21
-22.15771      105.1459      2.40431       0.2033          2    2     22
-22.15771      105.1459      4.80862       0.2033          2    2     23
-22.15771      105.1459      7.21293       0.2033          2    2     24
-22.15771      105.1459      9.61724       0.2033          2    2     25
-22.15771      105.1459      12.02155      0.2033          2    2     26
-22.15771      105.1459      14.42586      0.2033          2    2     27
-22.15771      105.1459      16.83017      0.2033          2    2     28
-22.15771      105.1459      19.23448      0.2033          2    2     29
-22.15771      105.1459      21.63879      0.2033          2    2     30
-22.15771      105.1459      24.0431       0.2033          2    2     31
-22.15771      105.1459      26.44741      0.2033          2    2     32
-22.15771      105.1459      28.85172      0.2033          2    2     33
-22.15771      105.1459      31.25603      0.2033          2    2     34
-22.15771      105.1459      33.66034      0.2033          2    2     35
-22.15771      105.1459      36.06465      0.2033          2    2     36
-22.15771      105.1459      38.46896      0.2033          2    2     37
-22.15771      105.1459      40.87327      0.2033          2    2     38
-22.15771      105.1459      43.27758      0.2033          2    2     39
-22.15771      105.1459      45.68189      0.2033          2    0     40

Sources:  2
Pulse No., Voltage Magnitude, Phase (Degrees): 1, 140.6, 16.3
Pulse No., Voltage Magnitude, Phase (Degrees): 21, 72.0, 57.8

Number of Loads:  0

********************    SOURCE DATA     ********************
Pulse  1      Voltage = (134.9696, 39.4102j)
              Current = (3.7527, 0.3102j)
              Impedance = (36.584, 7.478j)
              Power = 259.36 Watts

Pulse  21     Voltage = (38.3812, 60.9403j)
              Current = (2.6123, 1.3293j)
              Impedance = (21.099, 12.591j)
              Power = 90.64 Watts

Total Power = 350.000 Watts

********************    CURRENT DATA    ********************
```

Wire No. 1 :

Pulse No.	Real (Amps)	Imaginary (Amps)	Magnitude (Amps)	Phase (Degrees)
1	3.7527	0.3102	3.7655	4.7247
2	3.7699	0.2148	3.776	3.2618
3	3.7535	0.1616	3.7569	2.4652
4	3.7134	0.1168	3.7152	1.8015
5	3.6507	0.0781	3.6515	1.2256
6	3.566	0.0443	3.5663	0.7113
7	3.4601	0.0147	3.4601	0.2441
8	3.3334	-0.0108	3.3334	-0.1854
9	3.1867	-0.0325	3.1869	-0.5838
10	3.0208	-0.0504	3.0212	-0.9561
11	2.8364	-0.0647	2.8371	-1.306
12	2.6343	-0.0753	2.6354	-1.6367
13	2.4153	-0.0823	2.4167	-1.9507
14	2.1803	-0.0857	2.182	-2.2501
15	1.93	-0.0855	1.9319	-2.5368
16	1.6649	-0.0818	1.6669	-2.8126
17	1.3852	-0.0745	1.3873	-3.0789
18	1.0904	-0.0636	1.0922	-3.3375
19	0.7778	-0.0488	0.7793	-3.5903
20	0.4419	-0.0297	0.4429	-3.8446
E	0.0	0.0	0.0	0.0

Wire No. 2 :

Pulse No.	Real (Amps)	Imaginary (Amps)	Magnitude (Amps)	Phase (Degrees)
21	2.6123	1.3293	2.9311	26.9691
22	2.6397	1.3037	2.9441	26.2838
23	2.6383	1.2796	2.9323	25.8743
24	2.6184	1.2508	2.9017	25.5332
25	2.581	1.2165	2.8533	25.2358
26	2.527	1.1767	2.7876	24.9696
27	2.4569	1.1315	2.705	24.7275
28	2.3712	1.0809	2.6059	24.5048
29	2.2704	1.025	2.491	24.2982
30	2.1549	0.9642	2.3608	24.1052
31	2.0255	0.8986	2.2159	23.9239
32	1.8828	0.8285	2.057	23.7527
33	1.7272	0.7542	1.8847	23.5904
34	1.5594	0.676	1.6997	23.4357
35	1.3801	0.594	1.5025	23.2879
36	1.1895	0.5085	1.2937	23.146
37	0.988	0.4196	1.0734	23.0093
38	0.7751	0.3271	0.8413	22.8769
39	0.5495	0.2304	0.5958	22.748
40	0.3066	0.1277	0.3321	22.6199
E	0.0	0.0	0.0	0.0

********** BASE OPERATING PARAMETERS **********

Twr.	Ratio	Phase
1	1.000	0.0
2	0.778	22.2

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = kdco-1n.cir

I	3.7500	0	1	5.9200	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	.8700	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	36.5840	3	0	7.4780	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.550

NODE	VOLT MAG	VOLT PHASE
1	153.0530	27.3837
2	149.5694	27.9094
3	140.7895	15.8302

				BRANCH VOLTAGE		BRANCH CURRENT	FROM NODE IMPEDANCE		TO NODE IMPEDANCE	
				MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
VSWR											
R	1-	2	1.000	3.75	5.920	3.75	5.920	37.98	14.93	36.98	14.93
L	2-	3	.870	31.77	95.920	3.75	5.920	36.98	14.93	36.98	6.46
C	3-	0	.000	140.79	15.830	.11	105.830	.00	-1283.51	.00	.00
R	3-	0	36.584	140.79	15.830	3.77	4.278	36.58	7.48	.00	.00

Copy of file KDCO-1n.cir

```
1.550 0. 1
I 3.75 0 1  +5.92
R 1.000 1 2
L 0.87 2 3
C .00008 3 0
R 36.584 3 0  +7.478
EX
```

WESTBERG CIRCUIT ANALYSIS PROGRAM

FILE NAME = kdco-2n.cir

I	2.9000	0	1	27.9200	.0000	.0000
R	1.0000	1	2	.0000	.0000	.0000
L	1.5300	2	3	.0000	.0000	.0000
C	.0001	3	0	.0000	.0000	.0000
R	21.0990	3	0	12.5910	.0000	.0000
EX	.0000	0	0	.0000	.0000	.0000

FREQ = 1.550

NODE	VOLT MAG	VOLT PHASE
1	102.5266	78.3669
2	100.7048	79.6392
3	71.9500	57.7959

				BRANCH VOLTAGE		BRANCH CURRENT	FROM NODE IMPEDANCE		TO NODE IMPEDANCE	
				MAG	PHASE	MAG	PHASE	RESISTANCE	REACTANCE	RESISTANCE	REACTANCE
						VSWR					
R	1-	2	1.000	2.90	27.920	2.90	27.920	22.51	27.26	21.51	27.26
L	2-	3	1.530	43.21	117.920	2.90	27.920	21.51	27.26	21.51	12.36
C	3-	0	.000	71.95	57.796	.06	147.796	.00	-1283.51	.00	.00
R	3-	0	21.099	71.95	57.796	2.93	26.969	21.10	12.59	.00	.00

Copy of file KDCO-2N.CIR

```
1.550 0. 1
I 2.90 0 1 27.92
R 1.0000 1 2
L 1.53 2 3
C .00008 3 0
R 21.099 3 0 +12.591
EX
```

Summary of Post Construction Certified Array Geometry

With respect to Question 9, Section III, Page 2 of the attached Form 302-AM, the tower information is as follows:

Tower No.	Height above base insulator (meters)	Height above ground w/o obst. lighting (meters)	Overall height above ground (meters)
1	45.7	46.0	46.0
2	45.7	46.0	46.0

All towers are uniform cross-section, steel, guyed vertical radiators.

The tower relative distances provided in feet on the Certified Survey drawing attached hereto were converted to electrical degrees at 1550 kHz and used along with the survey tower azimuths relative to True North to calculate the X-Y coordinates of each tower with reference to the reference tower (#2). Likewise, the distances in electrical degrees and azimuths with reference to True North specified in the theoretical directional antenna pattern array geometry were used to calculate the X-Y coordinates of the specified tower locations. The differences in X and Y for the surveyor-measured and the specified coordinates of each tower were calculated, and each difference was used as a side of a right triangle. The square root of the sum of the squares of the sides was calculated to determine the positional error of each tower in electrical degrees.

Below is a tabulation showing those distances and other data that is relevant to their determination.

Twr.	Specified Array Geometry		Post-Construction Certification		Distance From Specified Base Location
	Spacing (degrees)	Azimuth (deg. T.)	Spacing (degrees)	Azimuth (deg. T.)	(deg.)
1 (W)	200	101.9	200.0	101.9	0.0
2 (E)	0	0	0	0	0

The as-built tower displacements from their specified locations expressed in electrical degrees at 1550 kHz, which corresponds 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.

Sampling System

The sampling system consists of Delta Electronics TCT-3 current transformers installed at the output of each antenna tuning unit, immediately adjacent to the final J-plug. Samples from the current transformers are fed to the antenna monitor via equal lengths of 1/4-inch foam-dielectric coaxial transmission lines. The antenna monitor is a Potomac Instruments AM19 Type 204.

Impedance measurements were made of the antenna sampling system using an Agilent E5061A network analyzer. The measurements were made looking into the antenna monitor ends of the sample lines with the tower ends of the sample lines open-circuited.

The table below shows the frequencies above and below the carrier frequency where resonance, defined as zero reactance corresponding with low resistance, was found. As the length of distortionless transmission line is 180 electrical degrees at the difference frequency between adjacent frequencies of resonance, and frequencies of resonance occur at odd multiples of 90 degrees electrical length, the sample line length at the resonant frequency above 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 frequencies.

Twr.	Sample Line Open-Circuited Resonance Below 1550 kHz (kHz)	Sample Line Open-Circuited Resonance Above 1550 kHz (kHz)	Sample Line Calculated Electrical Length At 1550 kHz (deg.)
1	1004.5	3004.3	138.9
2	1000.5	3046.2	139.4

Because the electrical lengths were determined to be 0.5 degrees different, the sample lines meet the requirement in the Rules that they be equal in length within one electrical degree.

To determine the characteristic impedance values of the sample 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 $R_1 + j X_1$ and $R_2 + j X_2$ are the measured impedances at the +45 and -45 degree offset frequencies, respectively:

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

Twr.	+ 45 Deg. Offset Frequenc y (kHz)	+45 Deg. Measured Impedance (ohms)	- 45 Deg. Offset Frequenc y (kHz)	-45 Deg. Measured Impedance (ohms)	Calculated Characteristic Impedance (ohms)
1	1506.8	13.3+j48.2	502.3	8.6 –j49.8	50.2
2	1500.8	1.5 +j49.9	500.3	5.7 –j49.8	50.0

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

The calibration of the Delta TCT-3 current transformers was verified by removing them all from the ATUs and installing them on a test jig so that each was located very close to the adjacent transformer (spacing of less than two inches). Short transmission lines of equal length were connected between the outputs of all four current transformers and the inputs of the antenna monitor. The Potomac AM19 antenna monitor was calibrated using the internal calibration function. A single source of RF current on the carrier frequency was fed through a conductor passing through all of the current transformers, and the differential phases and ratios were noted on the antenna monitor as follows:

Twr.	Ratio	Phase (deg.)
1	1.003	0.0
2	Ref.	Ref.

The requirement that the sample current transformers are accurate to within the manufacturer's specification (±2% ratio and ±2 degrees phase) has thus been demonstrated.

The impedance of each of the sample lines was measured with the sample current transformers attached. These impedances are tabulated below:

Twr.	R (ohms)	X (ohms)
1	50.8	-j1.2
2	51.0	-j1.1

Direct Measurement of Power

Common point impedance measurements were made using a Delta OIB-1A common point bridge installed in the common point bus of the phasing and coupling system. The resistance value was adjusted to 50 ohms and the reactance value was adjusted to zero.

The base impedance for nondirectional operation on tower 1 (W) was measured using a Delta OIB-1A operating impedance bridge and from the measured impedance of 47 +j26.3 is computed as 4.59Amps for 990 Watts

Appendix A

Certified Post-Construction Array Geometry Survey

Appendix B

Reference Field Strength Measurements

The reference field strength measurements will be supplied shortly after the grant of program test authority. There was not enough time after calculation of the operating parameters to fine adjust the phasing system and make the reference measurements.

TOWER LOCATION EXHIBIT

IN THE W 1/2 OF THE W 1/2 OF SECTION 9
T. 2 S., R. 70 W. OF THE 6TH P.M.
COUNTY OF JEFFERSON, STATE OF COLORADO.

NOTE: THIS IS NOT A LAND SURVEY PLAT OR AN IMPROVEMENT SURVEY PLAT.

SCALE: 1"=60'

TOWER SITE = METAL ANTENNA ON 3' X 3' CONCRETE BASE

COLORADO LICENSED
JEFF BELLIS JENNINGS
11619
1-30-14
P.E. AND P.L.S.

01/29/14

MAUNA TOWERS, LLC

1211-05

JOSEPH ASMUS
18300 HWY 72
ARVADA, CO 80007
303-906-3375