Engineering Statement

in support of

FCC Form 302-AM

December, 2023

KOKC

Oklahoma City, Oklahoma

licensed to:

TYLER MEDIA, LLC

prepared by:

Michael Patton & Associates
Baton Rouge, Louisiana
www.michaelpatton.com

Table of Contents:

Narrative Statement

Overview: TYLER MEDIA, LLC, licensee of KOKC, Oklahoma City, Oklahoma, has rebuilt the KOKC directional antenna array after the towers were knocked down by a tornado almost a decade ago. They contracted with this firm, Michael Patton & Associates, to design the new array's phasor and ATUs, to modify the existing phasor and oversee the construction of new ATU networks, to make the necessary measurements to develop a Method of Moments model, to tune the array in accordance with this model, to make the needed field strength measurements, and to complete the instant Form 302 application for station license and these exhibits.

Description of Array: KOKC operates non-directionally with a power of 50 kW during the day, using the center of the three towers, and with a power of 50 kW using all three towers in directional mode during night hours. All towers are identical triangular, series-fed base-insulated, guyed towers, of uniform cross-section, with an 18" face.

Changes to Tower Locations: Two of the legacy tower locations and base piers were reused. However, the location of the old tower 1 (NW) was abandoned to allow the front of the property to be developed commercially, and a new tower was erected at a suitable location on the SE side of the property. A new ground system was plowed in around this tower, consisting of 120 radials at least 80 M long except where limited by the property boundary. Repairs were made to the existing ground systems at the other two tower locations. A site plat with calculations showing the measured relationships between all towers is included here as Appendix 3. As noted on that plat, the measured bearing line of the towers is within 0.1° of the licensed value, while the measured distance between the towers is not quite as close to spec, but is within 0.75° (14") of the licensed value. This engineer views these discrepancies as *de minimus* deviations from licensed values, and does not expect these discrepancies to materially affect the generated directional pattern. Even though a new construction permit was applied for and received, there is no change to the directional antenna pattern.

ATUs and Doghouses: All new ATU networks were constructed on backplanes inside of new doghouse structures. All new feed and sample coax cables were buried to all towers, along with new power and RF contactor control cables and new ground strap.

Modifications to Phasor: The existing phasor, made by Kintronic Labs, was modified to supply the correct power at the correct phase shift to all towers to meet the array's calculated parameters. After the phasor was initially adjusted to display the calculated parameters on the antenna monitor, the phasor and ATUs were then fine-tuned to give good impedance matches to all coaxes, to ensure that no controls were at the end of their adjustment limits, and to ensure that all components were operating within their current limits. A complete RF schematic of the array is included here as Appendix 2.

Method of Moments Proof Methodology: This instant proof of performance was completed using the Method of Moments techniques, as outlined in §73.151 of the FCC Rules. Included in this Engineering Statement are the required mathematical model parameters, sample system measurements and certifications, and reference field strength measurements.

Modeling Software Used: The mathematical antenna model used here is the NEC3 analysis engine, incorporated into Westberg Consulting's Phasor Pro, v2.1.1.21.

Tower Matrix Model Impedance Measurements: Impedance measurements were made at each tower's ATU output j-plug, with the other towers' bases open-circuited at their ATUs' output j-plugs. The modeled electrical height and equivalent tower radius for all towers used in the model were then varied to obtain agreement between the predicted base impedances from the model and the actual measured ATU output impedances, using WCAP to determine the slight ratio and phase difference between the modeled base and measured ATU output impedances. It was determined that reasonable agreement could be achieved with the effective tower radius left equal to the actual radius and varying only the modeled height, while assuming reasonable feedline reactances. In this manner, good agreement was obtained between modeled and measured matrix impedances.

Derivation of Operating Parameters: Using these modeled heights, actual operating parameters were determined, again using WCAP to correct for the slight differences in currents and phases between the ATU output and the actual tower base caused by the effect of the base region components. The phasor and ATUs were then adjusted to display this parameter set on the antenna monitor; this parameter set is proposed for operating parameters for KOKC. See Page 4 for the mathematical model data, Page 5 for the notes, and Page 6 for the base region WCAP model schematic. The PhasorPro results page is included here as Appendix 1.

Narrative Statement (continued)

Sample System Requirements and Certifications: Delta TCT-1HV toroidal current sample transformers are used at all towers, mounted in each ATU in series with the feed to the tower base. All towers are less than 120° tall, so current samples are allowed by §73.151(c). These samples are fed back to the antenna monitor using the phase-stabilized version of RFS LCF12-50J Heliax-type cable, which has solid outer and center conductors and a foam dielectric, and which are of equal length and subject to the same environmental conditions along their entire runs. As part of this project, the antenna monitor, a Potomac 1901, was rebuilt by my firm. All toroidal sample transformers were tested by Delta Electronics and found to meet the factory specs. The procedures set forth in §73.151(c) for confirming proper operation of the sample system were followed, and the measurement data required for sample coax length and characteristic impedance are included here on Page 7.

Calibration of Instruments Used: The ND base current meter at Tower 2 was calibrated by Delta as part of this project. The CP current ammeter was compared to the base current meter and found to be in substantial agreement to the recently-calibrated meter, as part of this project. The operating impedance bridge in the phasor was compared to the OIB-3 impedance bridge used for testing, which was rebuilt by Delta in 2022, and found to be in substantial agreement. The vector network analyzer used was checked against known standards as part of this project. The Field Intensity Meter used for the reference measurements in this proof was rebuilt and calibrated in 2016, and was compared to several other such meters recently and found to be in substantial agreement. Data on the calibration of all equipment used in this Proof are given on Page 8.

Reference Field Strength Measurements: After the array was adjusted to display the derived parameters on the antenna monitor, the requisite three reference field strength measurements were made on each of the DA pattern's maxima and minima radials, at appropriate distances from the array. These measurements, a description of each measurement point, and their GPS coordinates are included on Page 9.

Changes to Array: The common point impedance was changed from its previous value to 50 Ohms as part of this project, to ensure minimal displayed reflected power in the main transmitter (Nautel NX50).

Compliance with Special Operating Conditions on Construction Permit:

Condition 1 (blanketing interference complaints): Licensee agrees to resolve any reasonable blanketing interference complaints within the 1V/m contour that may arise.

Condition 2 (RFR exposure above FCC limits): Licensee agrees to reduce power or cease operation to prevent exposure of persons having access to the site to RF EM fields above FCC limits.

Condition 3 (Ground system): Licensee has met this condition by the installation of the ground system for the new SE tower and the repairs to the existing towers' ground systems, as noted above.

Condition 4 (Antenna Proof of Performance): Licensee has complied with this condition by the submission of this Form 302 and accompanying exhibits.

Conclusions: The repairs and improvements to the KOKC array have been successfully and competently completed. The procedures for using and documenting the moment method proof as set forth in §73.151(c) of the FCC's rules have been followed, and the array is operating in accordance with the requirements for such arrays. The instant application has been carefully prepared in all particulars and should be granted. KOKC also hereby requests Program Test Authority immediately upon the filing of this application, to allow operation with the proposed parameters until such time as this application is approved and permanent license granted.

Respectfully Submitted,

George Michael Patton
Michael Patton & Associates
December 4, 2023

Moment method tower impedance model data

Parameter/item:	Tower 1 (NW):	Tower 2 (C):	Tower 2 (SE):
Tower data:			
Physical height of radiator	89.0°	89.0°	89.0°
Modeled velocity factor	0.925926	0.925926	0.925926
Modeled height of radiator	87.50°	88.68°	87.53°
Modeled/physical height ratio [1]	101.7%	100.4%	101.7%
Actual tower face width (uniform cross-section)	18"	18"	18"
Equivalent physical tower radius	8.3138"	8.3138"	8.3138"
Equivalent modeled tower radius	8.3138"	8.3138"	8.3138"
Modeled/physical radius ratio [2]	100.0%	100.0%	100.0%
Base region component values:			
Assumed tower feedline inductance [3]	4.3 uH (+j 41.1 Ω)	3.9 uH (+j 37.3 Ω)	4.3 uH (+j 41.1 Ω)
Base insulator capacitance (from manufacturer's specs)	20 pF (-j 5235 Ω)	20 pF (-j 5235 Ω)	20 pF (-j 5235 Ω)
Static drain choke impedance (from manufacturer's specs)	1600 uH (+j 15.3 KΩ)	1600 uH (+j 15.3 KΩ)	1600 uH (+j 15.3 KΩ)
Impedance data:			
Model-predicted impedance at tower base (from PhasorPro, using above tower values) [4]	48.6 +j 44.1 Ω	48.2 +j 50.2 Ω	48.6 +j 44.2 Ω
Model-predicted impedance at ATU output (through WCAP, using base region components) [5]	48.9 +j 84.7 Ω	48.6 +j 87.1 Ω	48.9 +j 84.9 Ω
Measured impedance at ATU output [6]	48.9 +j 84.5 Ω	48.6 +j 86.6 Ω	48.9 +j 85.3 Ω
Modeled/actual impedance deviation [7]	0.0 +j 0.2 Ω	0.0 +j 0.5 Ω	0.0 -j 0.4 Ω
Operating parameters:			
Theoretical parameters [8]	0.485 ∠ -119.5°	1.000 ∠ +0.0°	0.540 ∠ +114.5°
Predicted operating parameters at tower base [9]	0.423 ∠ -118.6°	1.000 ∠ +0.0°	0.595 ∠ +111.9°
Current ratio and phase shift due to base region components (modeled with WCAP) [10]	1:1.02 ∠ -0.44°	1:1.01 ∠ -0.31°	1:1.0 ∠ -0.11°
Predicted operating parameters at sample toroid location (ATU output) [11]	0.419 ∠ -118.7°	1.000 ∠ +0.0°	0.598 ∠ +112.1°

Moment method tower impedance model notes:

[1] The electrical height of the radiators used in the model are between 75 to 125 percent of the physical height, and therefore meets the criteria for such set forth in §73.151(c)(1)(v) of the FCC Rules.

[2] The equivalent radius of each radiator used in the model is between 80 and 150 percent of the physical radius, and therefore meets the criteria for such set forth in §73.151(c)(1)(i) of the FCC Rules.

[3] The inductances shown here are assumed to be the actual inductance of the feedline between the j-plug and the antenna base for each tower; these inductances are those needed to make the model's predicted tower base reactance agree with the measured reactances at the ATU output j-plugs. Using slightly different values for the three towers' feedlines is justified due to the natural variance of the inductance of a hand-wound single-turn feedline. These assumed values, being less than 10 uH, are within the tolerance for such allowed by §73.151(c)(1)(vii) of the FCC Rules.

[4] Modeled using Westberg Consulting's Phasor Pro v2.1.1.21, using the parameters shown for tower height and face width.

[5] These impedances are derived by running the impedances in the column above through a WCAP model of the base region components.

[6] These impedances were measured using an Array Solutions AIM-120 Vector Network Analyzer at each tower's ATU output j-plug, with the other towers in the array open-circuited at the output j-plug in their ATUs.

[7] The modeled base impedances, calculated using the data shown here, agree with the measured base impedances, within the tolerance limits specified in §73.151(c)(2)(ii) of the FCC Rules: (+/-2 ohms and +/-4 percent for resistance and reactance).

[8] Taken from the KOKC FCC Construction Permit File #: BP-20220203AAB

[9] Calculated using Westberg Consulting's Phasor Pro v2.1.1.21, using the measurements and assumptions detailed here.

[10] These are the calculated corrections that should be applied to the currents and phases predicted at the bases of the towers to obtain accurate currents and phases at the ATU output j-plugs (the sample point).

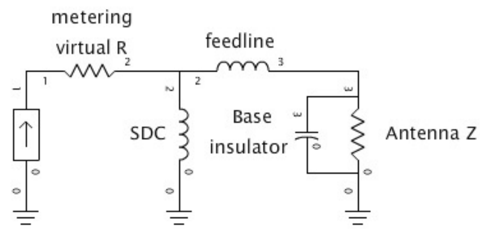
[11] Proposed operating parameters, after all corrections are applied, normalized to the reference tower (#2).

Tower base region WCAP model schematic:

Center Frequency: 1.52 MHz

Frequency Range: ±0 kHz

Frequency Step: 0 kHz



feedline: T1: 4.3 uH
T2: 3.9 uH
T3: 4.3 uH
SDC: 1600 uH
Insulator: 20 pF

Sample system data:

Parameter:	Tower 1 (NW):	Tower 1 (CW):	Tower 2 (SE):
Sample device used	Delta TCT-1HV S/N 1898	Delta TCT-1HV S/N 1582	Delta TCT-1HV S/N 1902
Type of sample coax used	RFS LCF12-50J	RFS LCF12-50J	RFS LCF12-50J
Sample coax cable velocity factor (% of C)	87%	87%	87%
Measured open-circuit resonant frequency nearest station frequency (1520 kHz)	1441.5 kHz	1441.4 kHz	1441.3 kHz
Calculated electrical line length at carrier	284.7°	284.7°	284.7°
Calculated coax length	135.7 meters	135.7 meters	135.7 meters
Coax resonant frequency + 1/8 λ	1201.3 kHz	1201.2 kHz	1201.1 kHz
Coax resonant frequency - 1/8 λ	1681.8 kHz	1681.6 kHz	1681.5 kHz
Measured coax impedance at $F_{resonance}$ + 1/8 λ	3.72 -j 50.50 Ω	3.79 -j 50.47 Ω	3.64 -j 50.57 Ω
Measured coax impedance at $F_{resonance}$ - 1/8 λ	5.35 +j 50.10 Ω	5.41 +j 50.14 Ω	5.36 +j 49.80 Ω
Calculated average characteristic impedance	50.5 Ω	50.5 Ω	50.4 Ω
Measured terminated coax impedance at station frequency	50.7 -j 1.7 Ω	50.4 -j 2.0 Ω	50.4 -j 1.8 Ω

Note: All of the measurements shown here were made in accordance with the provisions of § 73.151(c)(2)(i)

Operating Parameters & Equipment Lists:

Non-Directional Operating Parameters (Tower 1):

Power:	Antenna Base Impedance:	Antenna Base Current:
50.0 kW	50.5 +j 83.6 Ω	31.5 A

Directional Antenna Operating Parameters:

Power:	CP Impedance	CP Current:	Tower 1 (NW):	Tower 2 (C):	Tower 3 (SE):
52.65 kW	50.0 +j 0.0 Ω	32.45 A	0.419 ∠ -118.7°	1.000 ∠ +0.0°	.598 ∠ +112.1°

Operating Equipment List:

Type of Instrument:	Manu-facturer:	Model Number:	Serial Number:	Calibration Date:	By Whom Calibrated:
ND base ammeter	Delta	TCA-40EX-HV	3571	07/2023 [1]	Delta
Common Pt ammeter	Delta	TCA-40XM	250	06/2015 [1]	Delta
CP impedance bridge	Delta	CPB-1A	109	01/2013	Delta
Antenna monitor	Potomac	1901	345	09/2023	Patton

Test Equipment List:

Type of Instrument:	Manu-facturer:	Model Number:	Serial Number:	Calibration Date:	By Whom Calibrated:
Impedance bridge	Delta	OIB-3	216	08/2022 [2]	Delta
VNA	Array Solutions	AIM-120	1011	11/2009 [2]	Array
F. I. Meter	Potomac	FIM-41	2028	06/16/2016 [3]	Mooretronix

Notes:

[1] Both ammeters were checked against each other as part of this project and found to agree within the manufacturer's specification (2%).

[2] The VNA and bridge were checked against known standards as part of this project.

[3] The FIM-41 was checked against two other FIMs owned by MP&A just prior to this project; all were in substantial agreement with each other.

Field measurement reference data:

Point #:	GPS lat/lon:	Distance:	Description of measurement location:	Reading (mV/m):
Radial 83.8° (pattern minimum)				
84-1	35° 20’ 09.6” 97° 28’ 10.0”	3.17 km	305 South English Drive center of road at driveway to house	102
84-2	35° 20’ 14.1” 97° 27’ 20.6”	4.44 km	212 SouthWyndemere Lakes Drive center of street at mailbox for house	76
84-3	35° 20’ 20.8” 97° 26’ 05.0”	6.35 km	Country Lane 0.1 mile S of SE 128th Street between ponds on both sides	42
Radial 113.9° (minor lobe)				
114-1	35° 19’ 22.7” 97° 28’ 34.6”	2.79 km	Jury Lane 0.1 mile East of S Eastern Ave center of road	72
114-2	35° 19’ 00.5” 97° 27’ 33.1”	4.48 km	0.1 mile North of 2997 S Bryant Ave center of road	56
114-3	35° 18' 38.1” 97° 26’ 31.6”	6.18 km	2804 Land Run Road center of road at mailbox for house	28
Radial 144.0° (pattern minimum)				
144-1	35° 18’ 31.8” 97° 28’ 57.6”	3.33 km	3120 San Juan Trails center of road at mailbox for house	74
144-2	35° 17’ 54.6” 97° 28’ 24.3”	4.78 km	500 Manhattan Drive in front of mailbox	34
144-3	35° 17’ 13.3” 97° 27’ 47.6”	6.33 km	0.1 mile North of 5609 Spring Mill Road center of road	20
Radial 293.9° (major lobe)				
294-1	35° 20’ 45.3” 97° 32’ 22.7”	3.52 km	1309 SW 122nd Street center of street in front of mailbox	910
294-2	35° 21’ 02.3” 97° 33’ 10.2”	4.85 km	11825 Autumn Leaves center of street at mailbox	740
294-3	35° 21’ 23.3” 97° 34’ 08.1”	6.43 km	SW 111th Street @ Winelake Dr at center of intersection	560

Notes:

All readings were taken on November 14, 2023

All GPS figures shown were made using the GPS receiver in a Samsung Note 20 Ultra smartphone, using the WGS84 datum reference, and cross-checked with Google Earth. Distances were measured from the center of the array.

Certifications:

I, George Michael Patton, do hereby swear to and affirm the following:

That I am a broadcast engineer regularly engaged in the design, construction and repair of AM directional antennas, and my qualifications are a matter of record with the FCC;

That TYLER MEDIA, LLC, licensee of KOKC, Oklahoma City, Oklahoma, contracted my firm to make a moment method proof of performance on the KOKC array, and to prepare this form and report;

That all measurements made during the course of this work were made by me or under my direct supervision, and that all the measurements made by me are true and correct, and, as regards all measurements made by others, that I believe them to be both true and correct.

Sworn to this day, December 4, 2023

G. Michael Patton

____

George Michael Patton

KOKC Form 302 December, 2023
Appendix 1: PhasorPro run

STATION INFORMATION		
Call Letters	No. Towers	Frequency
KOKC	3	1.5200

TOWER INFORMATION						
	Tower Height (°)	Spacing (°)	Orientation	Face Width (in.)	Radius (in.)	Velocity Factor
Tower 1	87.5000	0.0000	0.0000	18.0000 / 18.0000	8.3138 / 8.3138	0.925926
Tower 2	88.6800	89.5000	113.9000	18.0000 / 18.0000	8.3138 / 8.3138	0.925926
Tower 3	87.5300	179.0000	113.9000	18.0000 / 18.0000	8.3138 / 8.3138	0.925926

MATRIX INFORMATION		
	Impedance (other towers open)	Impedance (other towers shorted)
Tower 1	48.58 + j44.06	59.06 + j55.02
Tower 2	48.21 + j50.21	75.22 + j93.69
Tower 3	48.64 + j44.23	59.14 + j55.20

DETUNED TOWER CURRENTS
Tower 1
0.000000 > 0.000000 - 87.50° above ground
0.344933 > -126.127991 - 77.78° above ground
0.523315 > -126.642381 - 68.06° above ground
0.585637 > -127.213718 - 58.33° above ground
0.528727 > -127.908912 - 48.61° above ground
0.348822 > -129.067445 - 38.89° above ground
0.043208 > -143.499660 - 29.17° above ground
0.399408 > 53.760657 - 19.44° above ground
0.986043 > 52.411503 - 9.72° above ground
1.974797 > 51.718309 - -0.00° above ground
Tower 2
0.000000 > 0.000000 - 88.68° above ground
0.351579 > -125.484195 - 78.83° above ground
0.534057 > -126.042305 - 68.97° above ground
0.598179 > -126.679614 - 59.12° above ground
0.540467 > -127.474102 - 49.27° above ground
0.356910 > -128.822027 - 39.41° above ground
0.045124 > -145.415351 - 29.56° above ground
0.408053 > 54.475174 - 19.71° above ground
1.007765 > 52.876815 - 9.85° above ground
2.016119 > 52.042717 - 0.00° above ground
Tower 3
0.000000 > 0.000000 - 87.53° above ground
0.238638 > 149.102548 - 77.80° above ground
0.358861 > 149.769535 - 68.08° above ground
0.397779 > 150.457698 - 58.35° above ground
0.354970 > 151.280307 - 48.63° above ground
0.229609 > 152.691079 - 38.90° above ground
0.022375 > 176.120526 - 29.18° above ground
0.275901 > -30.708051 - 19.45° above ground
0.665611 > -29.127464 - 9.73° above ground
1.316892 > -28.273981 - -0.00° above ground

-

ZMatrix		
48.58 + j44.06	24.27 - j22.54	-13.94 - j18.89
24.27 - j22.54	48.21 + j50.21	24.28 - j22.56
-13.94 - j18.89	24.28 - j22.56	48.64 + j44.23

YMatrix		
0.009065 - j0.008445	0.004151 + j0.004916	0.001119 - j0.000448
0.004151 + j0.004916	0.005211 - j0.006490	0.004149 + j0.004905
0.001119 - j0.000448	0.004149 + j0.004905	0.009036 - j0.008435

HMatrix - [I] = [H] X [F]		
0.026939 + j0.002543	0.000908 + j0.001418	0.001035 - j0.000437
0.000926 + j0.001450	0.026225 + j0.002596	0.000926 + j0.001450

0.001036 - j0.000437	0.000908 + j0.001419	0.026921 + j0.002544

HMatrix-inverse - [F] = [H]$^{-1}$ X [I]		
36.795780 - j3.392721	-1.525282 - j1.684992	-1.304401 + j0.990954
-1.557143 - j1.724042	37.712564 - j3.444888	-1.558426 - j1.724967
-1.305161 + j0.991548	-1.527341 - j1.686895	36.820009 - j3.398917

TOWER CURRENTS
Mode 1
Tower 1
0.000000 > 0.000000 - 87.50° above ground
0.344933 > -126.127991 - 77.78° above ground
0.523315 > -126.642381 - 68.06° above ground
0.585637 > -127.213718 - 58.33° above ground
0.528727 > -127.908912 - 48.61° above ground
0.348822 > -129.067445 - 38.89° above ground
0.043208 > -143.499660 - 29.17° above ground
0.399408 > 53.760657 - 19.44° above ground
0.986043 > 52.411503 - 9.72° above ground
1.974797 > 51.718309 - -0.00° above ground
Tower 2
0.000000 > 0.000000 - 88.68° above ground
7.732358 > -9.760188 - 78.83° above ground
13.834192 > -9.104673 - 68.97° above ground
19.202064 > -8.407342 - 59.12° above ground
23.763505 > -7.636380 - 49.27° above ground
27.423586 > -6.761240 - 39.41° above ground
30.085005 > -5.737717 - 29.56° above ground
31.661316 > -4.491758 - 19.71° above ground
32.080973 > -2.895083 - 9.85° above ground
30.908090 > 0.000000 - 0.00° above ground
Tower 3
0.000000 > 0.000000 - 87.53° above ground
0.345111 > -126.125476 - 77.80° above ground
0.523598 > -126.639931 - 68.08° above ground
0.585963 > -127.211462 - 58.35° above ground
0.529025 > -127.906986 - 48.63° above ground
0.349019 > -129.066153 - 38.90° above ground
0.043230 > -143.507413 - 29.18° above ground
0.399640 > 53.763388 - 19.45° above ground
0.986599 > 52.413478 - 9.73° above ground
1.975821 > 51.719869 - -0.00° above ground
Mode 2
Tower 1
0.000000 > 0.000000 - 87.50° above ground
4.210205 > -126.741279 - 77.78° above ground
7.408918 > -126.350060 - 68.06° above ground
10.104373 > -125.913939 - 58.33° above ground
12.259993 > -125.404490 - 48.61° above ground
13.827121 > -124.789757 - 38.89° above ground
14.754999 > -124.020826 - 29.17° above ground
14.994421 > -123.010624 - 19.44° above ground
14.496005 > -121.591216 - 9.72° above ground
12.739437 > -118.605477 - -0.00° above ground
Tower 2
0.000000 > 0.000000 - 88.68° above ground
7.790829 > -7.539199 - 78.83° above ground
13.917413 > -7.044891 - 68.97° above ground
19.283102 > -6.518509 - 59.12° above ground
23.812322 > -5.935208 - 49.27° above ground
27.406603 > -5.270658 - 39.41° above ground
29.964608 > -4.489337 - 29.56° above ground
31.394269 > -3.531218 - 19.71° above ground
31.614851 > -2.290664 - 9.85° above ground
30.088366 > 0.000000 - 0.00° above ground
Tower 3

0.000000 > 0.000000 - 87.53° above ground
3.999184 > 108.294419 - 77.80° above ground
7.213432 > 108.647998 - 68.08° above ground
10.101777 > 108.995962 - 58.35° above ground
12.624676 > 109.349146 - 48.63° above ground
14.729993 > 109.715441 - 38.90° above ground
16.363477 > 110.106442 - 29.18° above ground
17.476950 > 110.541775 - 19.45° above ground
18.031177 > 111.054419 - 9.73° above ground
17.904150 > 111.905831 - -0.00° above ground

FIELD INFORMATION - DAY		
	Field Ratio	**Field Phase**
Tower 2	1.0000	0.0000

FIELD INFORMATION - NIGHT		
	Field Ratio	**Field Phase**
Tower 1	0.4850	-119.5000
Tower 2	1.0000	0.0000
Tower 3	0.5400	114.5000

TOWER DRIVE INFORMATION - DAY					
	Field Ratios	**Field Phase**	**Drive Imped. (Ω)**	**Current**	**Power (W)**
Tower 1	0.0000	0.0000	-6.98 - j491.59	1.97 ∡ 51.72	-27.2027
Tower 2	1.0000	0.0000	52.40 + j50.86	30.91 ∡ 0.00	50054.4452
Tower 3	0.0000	0.0000	-6.98 - j491.45	1.98 ∡ 51.72	-27.2425

TOWER DRIVE INFORMATION - NIGHT					
	Field Ratios	**Field Phase**	**Drive Imped. (Ω)**	**Current**	**Power (W)**
Tower 1	0.4850	-119.5000	59.85 + j151.89	12.74 ∡ -118.61	9713.5495
Tower 2	1.0000	0.0000	41.98 + j64.17	30.09 ∡ 0.00	38000.6662
Tower 3	0.5400	114.5000	14.93 + j21.41	17.90 ∡ 111.91	4785.7844

TRANSMISSION LINE INFORMATION - DAY				
	Length (ft.)	**Velocity**	Z_0	**Phase**
Tower 2	261.0000	92.0000	50.0000	-157.7625

TRANSMISSION LINE INFORMATION - NIGHT				
	Length (ft.)	**Velocity**	Z_0	**Phase**
Tower 1	86.0000	92.0000	50.0000	-51.9830
Tower 2	261.0000	92.0000	50.0000	-157.7625
Tower 3	430.0000	92.0000	50.0000	-259.9152

SYSTEM PHASING INFORMATION - DAY					
	PD Type	**PD Phase**	**PShifter**	**ACU Phase**	**I Phase**
Tower 2	Shunt	0.0000	0.0000	-72.2400	0.0000

SYSTEM PHASING INFORMATION - NIGHT					
	PD Type	**PD Phase**	**PShifter**	**ACU Phase**	**I Phase**
Tower 1	Shunt	-31.1500	0.0000	79.5300	-118.6056
Tower 2	Shunt	0.0000	0.0000	-87.2400	0.0000
Tower 3	Shunt	-31.2900	-100.0000	-101.8900	111.9058

ACU - Tower 2 - DAY			
	Input Leg	**Shunt Leg**	**Output Leg**
Reactance(Ω)	37.7306	-53.7454	-13.8943
Inductance(µH)	3.9507	5.3361	9.5088
Capacitance(µF)	0.000000	0.001000	0.001000
Current(RMS Amps)	31.6400	36.8755	30.9081
Cap. Volts(RMS)	0.0000	3861.1281	3236.2995

COMMON POINT TEE - NIGHT			
	Input Leg	**Shunt Leg**	**Output Leg**

Reactance(Ω)	19.1663	-37.3648	11.5263
Inductance(μH)	4.2909	4.8585	4.8614
Capacitance(μF)	0.004800	0.001250	0.003000
Current(RMS Amps)	32.4037	46.4379	46.1441
Cap. Volts(RMS)	706.8544	3889.9033	1610.5407

ZERO DEGREE PHASE SHIFTER - Tower 1 - NIGHT	
Capacitance(μF)	0.002400
Inductance(μH)	4.5682
Current(RMS Amps)	13.9381
Cap. Volts(RMS)	608.0920

ACU - Tower 1 - NIGHT			
	Input Leg	**Shunt Leg**	**Output Leg**
Reactance(Ω)	-46.3910	55.6309	-196.4558
Inductance(μH)	8.8470	5.8250	15.9750
Capacitance(μF)	0.000800	0.000000	0.000300
Current(RMS Amps)	13.9381	17.0889	12.7394
Cap. Volts(RMS)	1824.2759	0.0000	4446.3619

ZERO DEGREE PHASE SHIFTER - Tower 2 - NIGHT	
Capacitance(μF)	0.002600
Inductance(μH)	4.2168
Current(RMS Amps)	27.5683
Cap. Volts(RMS)	1110.2321

ACU - Tower 2 - NIGHT			
	Input Leg	**Shunt Leg**	**Output Leg**
Reactance(Ω)	43.4551	-45.8655	-20.3278
Inductance(μH)	4.5501	6.1612	8.8351
Capacitance(μF)	0.000000	0.001000	0.001000
Current(RMS Amps)	27.5683	39.8176	30.0884
Cap. Volts(RMS)	0.0000	4169.1870	3150.4685

PHASE SHIFTER - Tower 3 - NIGHT			
	Input Leg	**Shunt Leg**	**Output Leg**
Reactance(Ω)	59.5877	-50.7713	59.5877
Inductance(μH)	14.6728	5.6475	6.2393
Capacitance(μF)	0.001300	0.001000	0.000000
Current(RMS Amps)	9.7834	14.9891	9.7834
Cap. Volts(RMS)	787.9973	1569.4666	0.0000

ACU - Tower 3 - NIGHT			
	Input Leg	**Shunt Leg**	**Output Leg**
Reactance(Ω)	38.4482	-27.9207	9.6579
Inductance(μH)	4.0258	0.7310	7.6964
Capacitance(μF)	0.000000	0.003000	0.001640
Current(RMS Amps)	9.7834	22.1010	17.9042
Cap. Volts(RMS)	0.0000	771.3791	1143.1090

IMPEDANCE BANDWIDTH - DAY		
Frequency	**Common Point Impedance**	**VSWR**
1.5100	46.50 + j2.43	1.0925
1.5200	50.00 + j0.00	1.0000
1.5300	52.81 - j3.67	1.0942

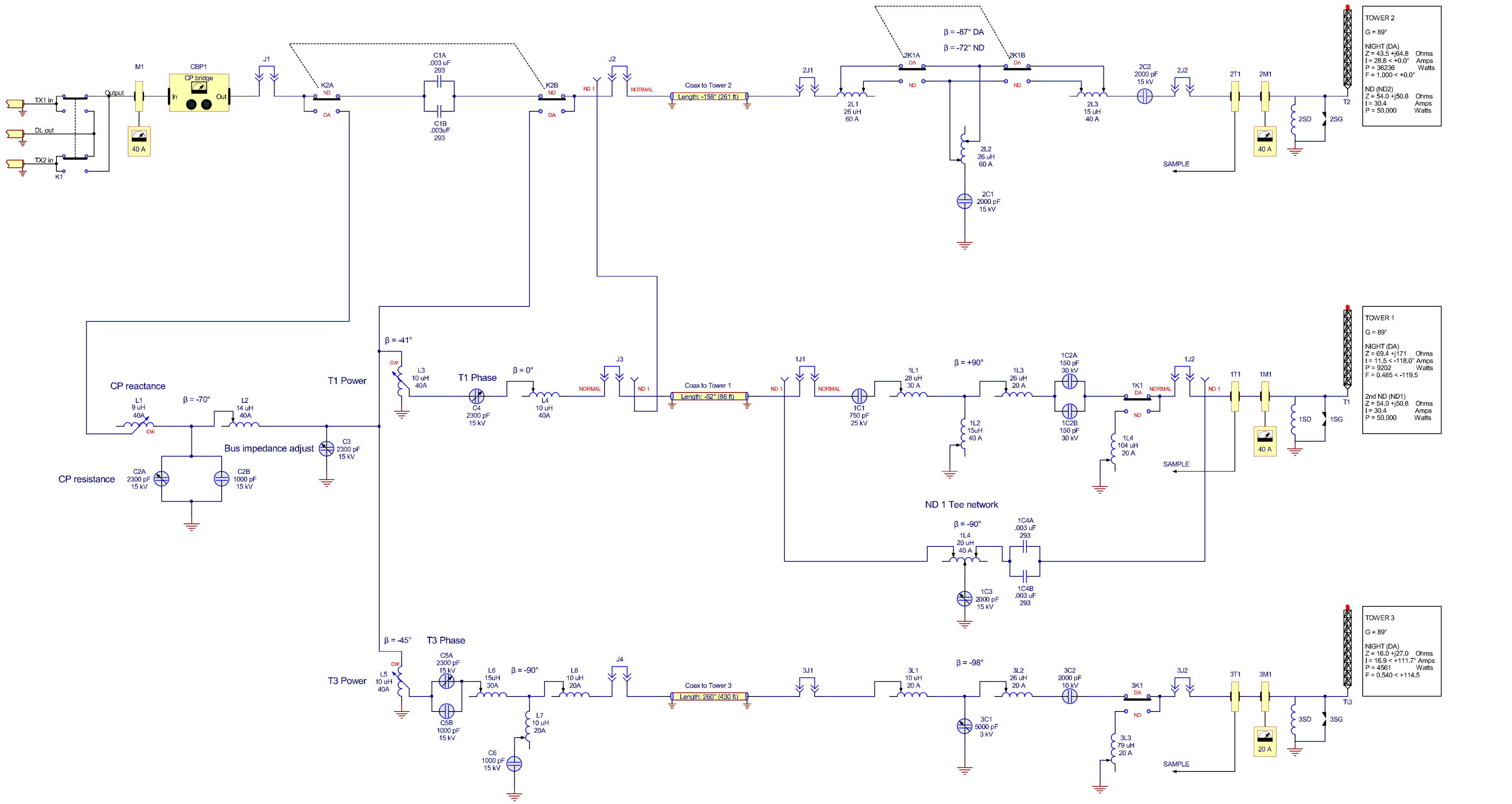
FIELD RATIOS - DAY			
	-0.010 MHz	**Carrier**	**+0.010 MHz**
Tower 1	0.00 ∡ 51.33	0.00 ∡ 175.04	0.00 ∡ -129.60
Tower 2	1.00 ∡ 0.00	1.00 ∡ 0.00	1.00 ∡ 0.00
Tower 3	0.00 ∡ 51.46	0.00 ∡ 110.11	0.00 ∡ -129.72

IMPEDANCE BANDWIDTH - NIGHT		
Frequency	**Common Point Impedance**	**VSWR**

1.5100	52.63 + j4.13	1.1001
1.5200	50.00 + j0.00	1.0000
1.5300	46.54 - j3.12	1.1013

FIELD RATIOS - NIGHT			
	-0.010 MHz	**Carrier**	**+0.010 MHz**
Tower 1	0.47 ∡ -116.05	0.48 ∡ -119.50	0.50 ∡ -122.92
Tower 2	1.00 ∡ 0.00	1.00 ∡ 0.00	1.00 ∡ 0.00
Tower 3	0.57 ∡ 120.65	0.54 ∡ 114.50	0.51 ∡ 110.17

KOKC Form 302 December, 2023
Appendix 2: Overall RF schematic

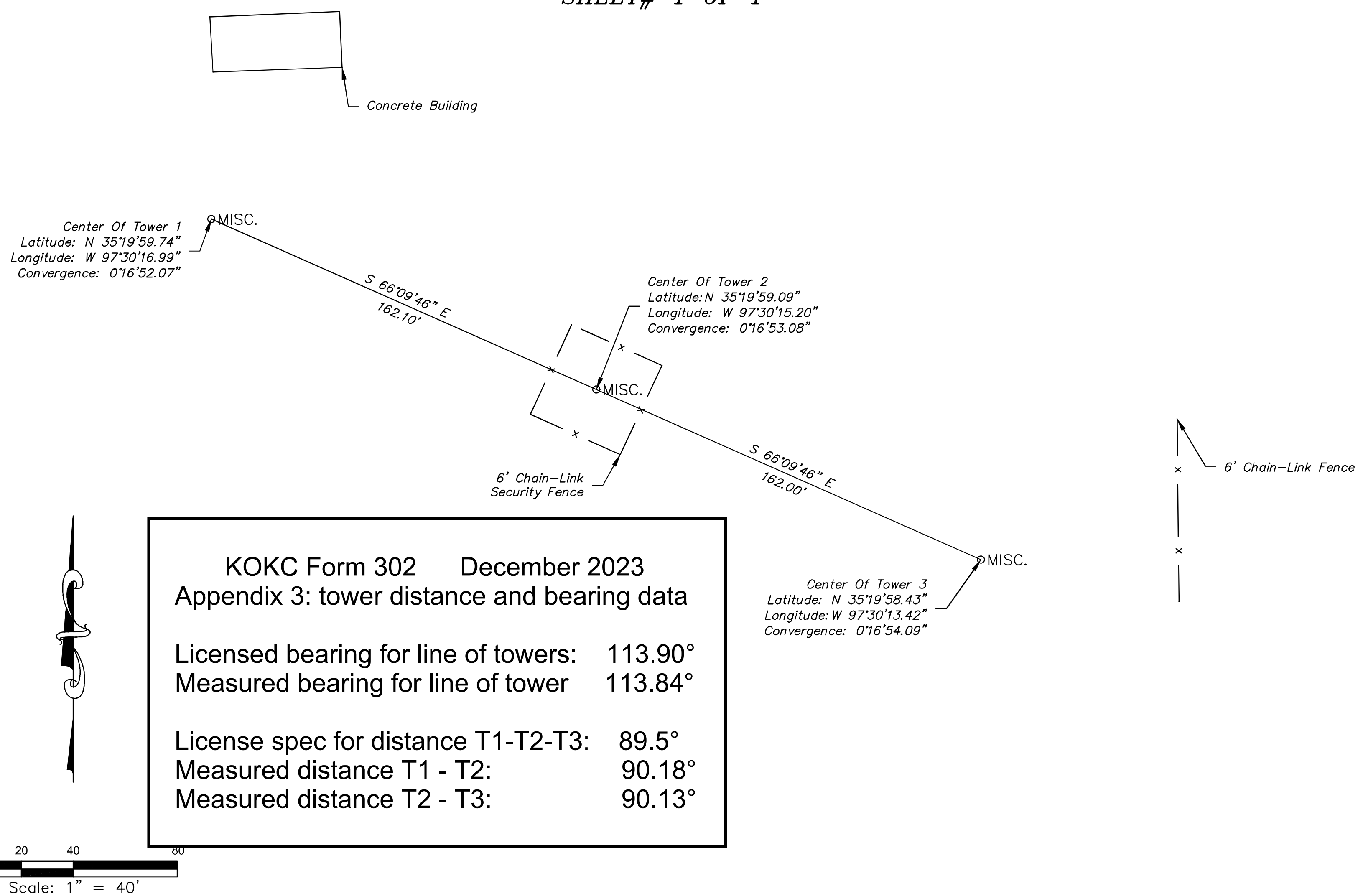


Title: KOKC overall			
Project: KOKC DA rebuild		Revision: 1.0	
Size: C landscape	Last update: 5/1/2023	Sheet 1 of 1	
File: KOKC Overall.SchDoc			

Michael Patton & Associates
12231 Industriplex Blvd, Suite C
Baton Rouge, LA 70809
michaelpatton.com
Engineer: GMP Drawn by: GMP Checked by: GMP

1520 KOKC AM TOWERS

820 SW 4th ST
MOORE, OK 73160
CLEVELAND COUNTY
TOWER SURVEY
SHEET# 1 OF 1



KOKC Form 302 December 2023
Appendix 3: tower distance and bearing data

Licensed bearing for line of towers:	113.90°
Measured bearing for line of tower	113.84°
License spec for distance T1-T2-T3:	89.5°
Measured distance T1 - T2:	90.18°
Measured distance T2 - T3:	90.13°

BEARING TREE LAND SURVEYING, L.L.C.
7100 Broadway Ext., Oklahoma City, OK 73116
Telephone: (405) 605-1081
Oklahoma CA #4568 Renewal date 06/30/22 Texas Reg. # 6145
WWW.BEARINGTREESURVEYING.COM
TOPOGRAPHIC • LiDAR • GPS • PHOTOGRAMMETRY
ALTA/ACSM LAND TITLE • CONSTRUCTION • GIS

REGISTERED PROFESSIONAL LAND SURVEYOR
JACOB ROYCE CARROLL
R.P.L.S. 1522
OKLAHOMA

Party Chief:	CWA
Processed By:	CWA
Drawn By:	JSN
Checked By:	JRC
Scale:	1"=40'
Date:	5/4/21
Revision Date:	N/A