



## **ENGINEERING STATEMENT**

OF

**JOHN F.X. BROWNE, P.E.**

**IN SUPPORT OF AN APPLICATION FOR LICENSE**

**FM Translator W296AX**

**Escanaba, MI**

**Board of Trustees of Northern Michigan University**

### **Background**

The Board of Trustees of Northern Michigan University (NMU) is the licensee of Non-Commercial (NCE) stations WNMU-FM (BLED-1511, Facility ID 49572), and WNMU-DT, Marquette, MI. NMU also holds a license for FM translator station W296AX at Escanaba, MI (BLFT-19980218TK, Facility ID 4262). W296AX (CH296, 107.1 MHz) was displaced by WUPF-FM at Powers, MI (BLH-20080304AAD and NMU filed for a Construction Permit to change the frequency of W296AX to CH243 (96.5 MHz). NMU was granted that Construction Permit (BPFT-20080923AEH) and is now filing for a license to cover completion of construction.

### **Station Parameters**

The station's authorized parameters are listed below:

The coordinates of the site are:

(NAD27)  
45° 44' 43" N. Latitude  
87° 03' 14" W. Longitude



Frequency:	96.5 MHz (CH243)
Polarization:	Horizontal
ERP:	0.031 kW
HAAT:	42.5m
RC AMSL:	234.6m
RC AGL:	51.6

The antenna patterns for the Scala CA-4 (70° skew) antenna are attached as well as the Manufacturer's installation instructions. A statement is attached from the WNMU acting Chief Transmitter Engineer that certifies the facility was constructed as authorized in the underlying construction permit. A certification from a licensed surveyor that the antenna is oriented correctly is also attached.

### **Environmental/RFR**

The proposed construction does not require preparation of an Environmental Assessment as it does not involve any of the factors listed in Section 1.1306.

The additional ground level RFR contributed to the site by this proposal in public areas is calculated to be 0.000012 mW/cm<sup>2</sup> which is less than 5% of the MPE for public exposure (0.2 mW/cm<sup>2</sup>) at the proposed frequency.

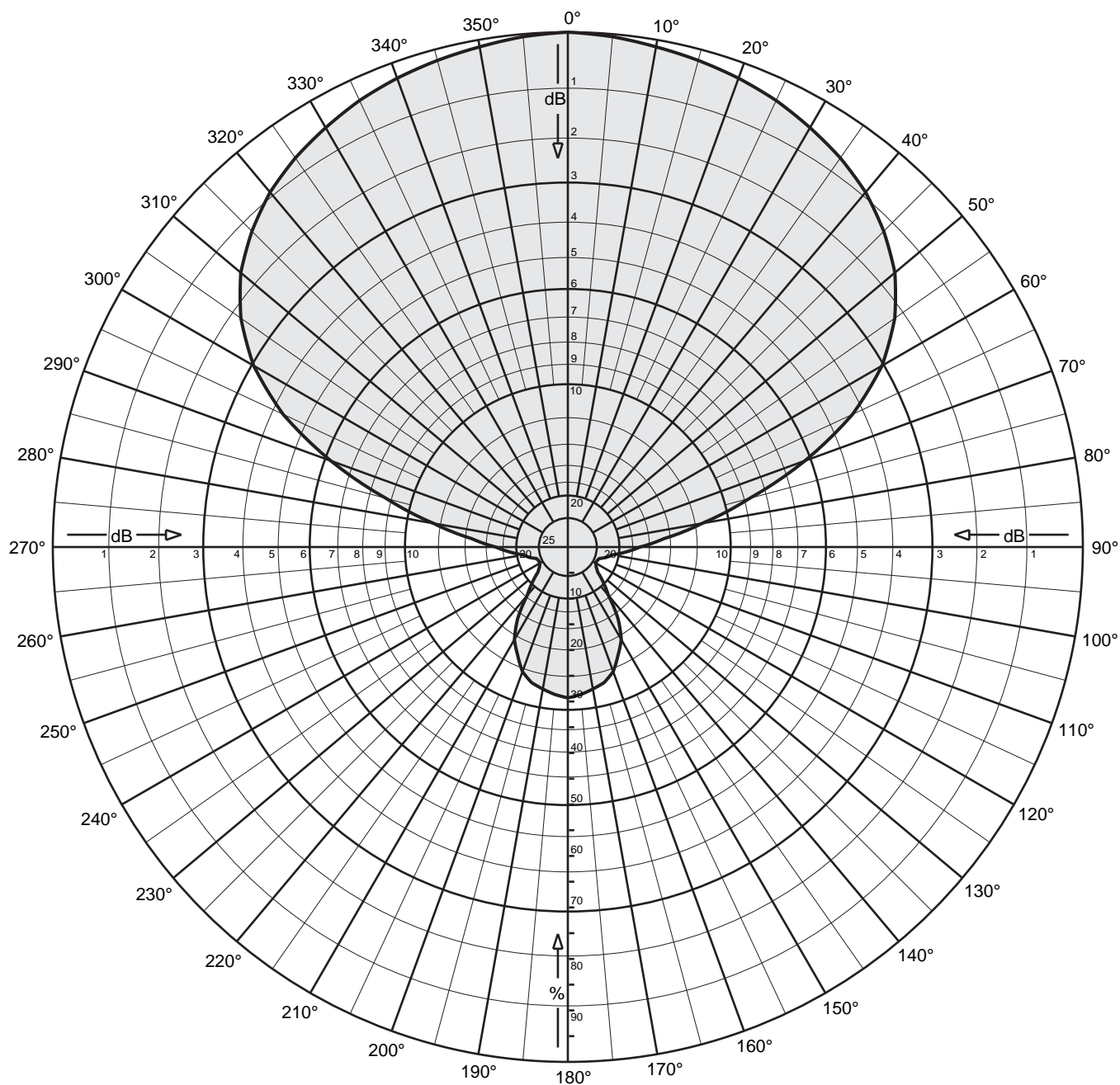
NMU agrees to comply with the Commission's requirements regarding power adjustments or cessation of operation as may be necessary to ensure a compliant environment for worker access. Access to the roof top where the antenna is mounted is provided to workers by a locked door, however, public access to the roof top is prohibited. Workers will be trained on RFR issues and be encouraged to wear personal RFR monitors when working on or near the structure or on the roof near the antenna.

**Certification**

I hereby certify that the foregoing report or statement was prepared by me but may include work performed by others under my supervision or direction. The statements of fact contained therein are believed to be true and correct based on personal knowledge, information and belief unless otherwise stated; with respect to facts not known of my own personal knowledge, I believe them to be true and correct based on their origin from sources known to me to be generally reliable and accurate. I have prepared this document with due care and in accordance with applicable standards of professional practice.

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John F. X. Browne, P.E.  
March 10, 2010



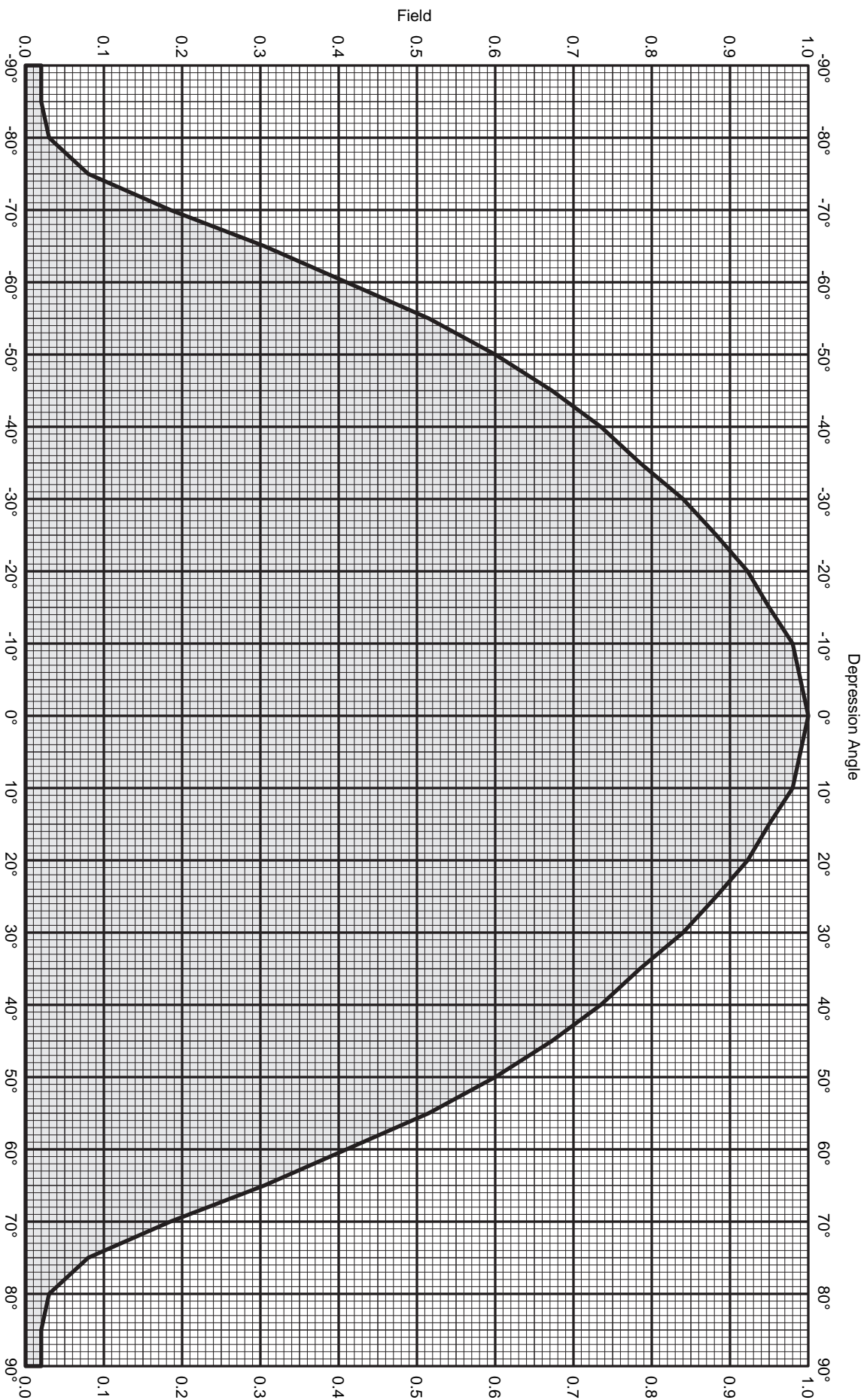
Two CA-2 yagi Antennas skewed 70 degrees  
 Any single channel 88-108 MHz  
 Gain: 5.0 dBd (x 3.16)  
 Horizontal Polarization  
 Vertical Stacked (0.5 wavelength)  
 Horizontal plane Pattern



Two CA-2 yagi Antennas skewed 70 degrees  
 Any single channel 88-108 MHz  
 Gain: 5.0 dBd (x 3.16)  
 Horizontal Polarization

Vertical Stacked (0.5 wavelength)  
 Horizontal plane Pattern

Angle	Field	Rel.dB	dBd	PwrMult	Angle	Field	Rel.dB	dBd	PwrMult
0	1.000	0.00	5.00	3.16	180	0.293	-10.66	-5.66	0.27
5	0.995	-0.04	4.96	3.13	185	0.287	-10.83	-5.83	0.26
10	0.987	-0.12	4.88	3.08	190	0.280	-11.06	-6.06	0.25
15	0.979	-0.19	4.81	3.03	195	0.273	-11.29	-6.29	0.23
20	0.969	-0.27	4.73	2.97	200	0.257	-11.78	-6.78	0.21
25	0.957	-0.38	4.62	2.90	205	0.231	-12.73	-7.73	0.17
30	0.941	-0.53	4.47	2.80	210	0.207	-13.66	-8.66	0.14
35	0.923	-0.70	4.30	2.69	215	0.170	-15.39	-10.39	0.09
40	0.900	-0.92	4.08	2.56	220	0.123	-18.24	-13.24	0.05
45	0.868	-1.23	3.77	2.38	225	0.097	-20.22	-15.22	0.03
50	0.829	-1.63	3.37	2.17	230	0.075	-22.44	-17.44	0.02
55	0.775	-2.21	2.79	1.90	235	0.067	-23.48	-18.48	0.01
60	0.704	-3.04	1.96	1.57	240	0.062	-24.08	-19.08	0.01
65	0.610	-4.29	0.71	1.18	245	0.062	-24.08	-19.08	0.01
70	0.490	-6.20	-1.20	0.76	250	0.065	-23.74	-18.74	0.01
75	0.366	-8.74	-3.74	0.42	255	0.078	-22.21	-17.21	0.02
80	0.265	-11.54	-6.54	0.22	260	0.087	-21.16	-16.16	0.02
85	0.188	-14.54	-9.54	0.11	265	0.112	-18.98	-13.98	0.04
90	0.140	-17.08	-12.08	0.06	270	0.140	-17.08	-12.08	0.06
95	0.112	-18.98	-13.98	0.04	275	0.188	-14.54	-9.54	0.11
100	0.087	-21.16	-16.16	0.02	280	0.265	-11.54	-6.54	0.22
105	0.078	-22.21	-17.21	0.02	285	0.366	-8.74	-3.74	0.42
110	0.065	-23.74	-18.74	0.01	290	0.490	-6.20	-1.20	0.76
115	0.062	-24.08	-19.08	0.01	295	0.610	-4.29	0.71	1.18
120	0.062	-24.08	-19.08	0.01	300	0.704	-3.04	1.96	1.57
125	0.067	-23.48	-18.48	0.01	305	0.775	-2.21	2.79	1.90
130	0.075	-22.44	-17.44	0.02	310	0.829	-1.63	3.37	2.17
135	0.097	-20.22	-15.22	0.03	315	0.868	-1.23	3.77	2.38
140	0.123	-18.24	-13.24	0.05	320	0.900	-0.92	4.08	2.56
145	0.170	-15.39	-10.39	0.09	325	0.923	-0.70	4.30	2.69
150	0.207	-13.66	-8.66	0.14	330	0.941	-0.53	4.47	2.80
155	0.231	-12.73	-7.73	0.17	335	0.957	-0.38	4.62	2.90
160	0.257	-11.78	-6.78	0.21	340	0.969	-0.27	4.73	2.97
165	0.273	-11.29	-6.29	0.23	345	0.979	-0.19	4.81	3.03
170	0.280	-11.06	-6.06	0.25	350	0.987	-0.12	4.88	3.08
175	0.287	-10.83	-5.83	0.26	355	0.995	-0.04	4.96	3.13



# KATHREIN SCALA DIVISION

Post Office Box 4580  
Medford, OR 97501 (USA)  
Phone: (541) 779-6500  
Fax: (541) 779-3991  
<http://www.kathrein-scala.com>

Two CA-2 yagi Antennas skewed 70 degrees

Any single channel 88-108 MHz

Gain: 5.0 dBi (x 3.16)

Horizontal Polarization

Vertical Stacked (0.5 wavelength)

Vertical plane Pattern



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Angle	Field	Rel.dB	dBd	PwrMult	Angle	Field	Rel.dB	dBd	PwrMult
-90	0.020	-33.98	-28.98	0.00	-45	0.673	-3.45	1.55	1.43
-89	0.020	-33.98	-28.98	0.00	-44	0.685	-3.29	1.71	1.48
-88	0.020	-33.98	-28.98	0.00	-43	0.697	-3.13	1.87	1.54
-87	0.020	-33.98	-28.98	0.00	-42	0.710	-2.97	2.03	1.59
-86	0.020	-33.98	-28.98	0.00	-41	0.722	-2.82	2.18	1.65
-85	0.020	-33.98	-28.98	0.00	-40	0.735	-2.67	2.33	1.71
-84	0.022	-33.15	-28.15	0.00	-39	0.745	-2.56	2.44	1.76
-83	0.024	-32.40	-27.40	0.00	-38	0.755	-2.44	2.56	1.80
-82	0.026	-31.70	-26.70	0.00	-37	0.765	-2.33	2.67	1.85
-81	0.028	-31.06	-26.06	0.00	-36	0.775	-2.21	2.79	1.90
-80	0.030	-30.46	-25.46	0.00	-35	0.785	-2.10	2.90	1.95
-79	0.040	-27.96	-22.96	0.01	-34	0.796	-1.98	3.02	2.00
-78	0.050	-26.02	-21.02	0.01	-33	0.807	-1.86	3.14	2.06
-77	0.060	-24.44	-19.44	0.01	-32	0.818	-1.74	3.26	2.12
-76	0.070	-23.10	-18.10	0.02	-31	0.829	-1.63	3.37	2.17
-75	0.080	-21.94	-16.94	0.02	-30	0.840	-1.51	3.49	2.23
-74	0.101	-19.91	-14.91	0.03	-29	0.849	-1.43	3.57	2.28
-73	0.122	-18.27	-13.27	0.05	-28	0.857	-1.34	3.66	2.32
-72	0.143	-16.89	-11.89	0.06	-27	0.865	-1.25	3.75	2.37
-71	0.164	-15.70	-10.70	0.09	-26	0.874	-1.17	3.83	2.42
-70	0.185	-14.66	-9.66	0.11	-25	0.883	-1.09	3.91	2.46
-69	0.209	-13.60	-8.60	0.14	-24	0.891	-1.01	3.99	2.51
-68	0.233	-12.65	-7.65	0.17	-23	0.898	-0.93	4.07	2.55
-67	0.257	-11.80	-6.80	0.21	-22	0.906	-0.85	4.15	2.60
-66	0.281	-11.03	-6.03	0.25	-21	0.914	-0.78	4.22	2.64
-65	0.305	-10.31	-5.31	0.29	-20	0.923	-0.70	4.30	2.69
-64	0.326	-9.74	-4.74	0.34	-19	0.928	-0.65	4.35	2.72
-63	0.347	-9.19	-4.19	0.38	-18	0.933	-0.60	4.40	2.76
-62	0.368	-8.68	-3.68	0.43	-17	0.939	-0.55	4.45	2.79
-61	0.389	-8.20	-3.20	0.48	-16	0.944	-0.50	4.50	2.82
-60	0.410	-7.74	-2.74	0.53	-15	0.950	-0.45	4.55	2.85
-59	0.431	-7.31	-2.31	0.59	-14	0.956	-0.39	4.61	2.89
-58	0.452	-6.90	-1.90	0.65	-13	0.962	-0.34	4.66	2.93
-57	0.473	-6.50	-1.50	0.71	-12	0.968	-0.28	4.72	2.96
-56	0.494	-6.13	-1.13	0.77	-11	0.974	-0.23	4.77	3.00
-55	0.515	-5.76	-0.76	0.84	-10	0.980	-0.18	4.82	3.04
-54	0.532	-5.48	-0.48	0.90	-9	0.982	-0.16	4.84	3.05
-53	0.549	-5.21	-0.21	0.95	-8	0.984	-0.14	4.86	3.06
-52	0.566	-4.94	0.06	1.01	-7	0.986	-0.12	4.88	3.07
-51	0.583	-4.69	0.31	1.07	-6	0.988	-0.10	4.90	3.09
-50	0.600	-4.44	0.56	1.14	-5	0.990	-0.09	4.91	3.10
-49	0.615	-4.23	0.77	1.19	-4	0.992	-0.07	4.93	3.11
-48	0.629	-4.03	0.97	1.25	-3	0.994	-0.05	4.95	3.12
-47	0.643	-3.83	1.17	1.31	-2	0.996	-0.03	4.97	3.14
-46	0.658	-3.64	1.36	1.37	-1	0.998	-0.02	4.98	3.15
					0	1.000	0.00	5.00	3.16



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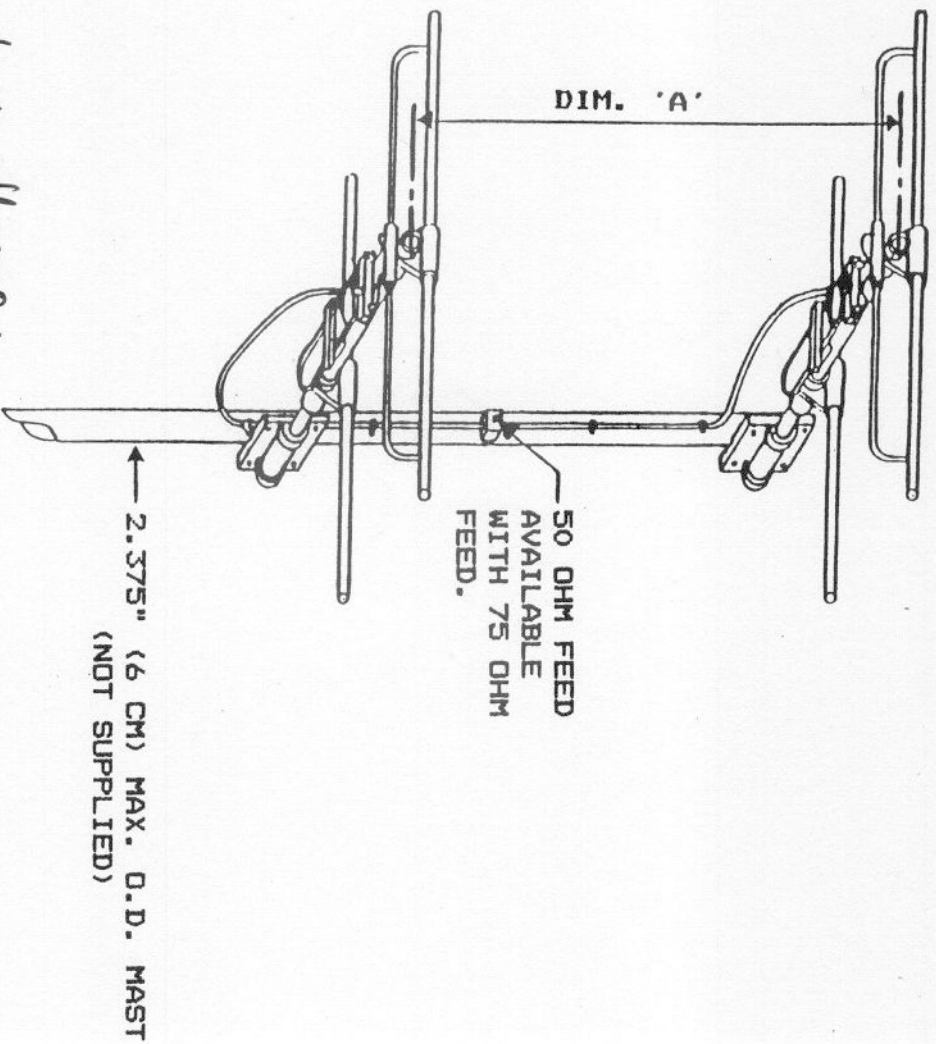
Vertical Stacked (0.5 wavelength)  
 Vertical plane Pattern

Angle	Field	Rel.dB	dBd	PwrMult	Angle	Field	Rel.dB	dBd	PwrMult
0	1.000	0.00	5.00	3.16	45	0.673	-3.45	1.55	1.43
1	0.998	-0.02	4.98	3.15	46	0.658	-3.64	1.36	1.37
2	0.996	-0.03	4.97	3.14	47	0.643	-3.83	1.17	1.31
3	0.994	-0.05	4.95	3.12	48	0.629	-4.03	0.97	1.25
4	0.992	-0.07	4.93	3.11	49	0.615	-4.23	0.77	1.19
5	0.990	-0.09	4.91	3.10	50	0.600	-4.44	0.56	1.14
6	0.988	-0.10	4.90	3.09	51	0.583	-4.69	0.31	1.07
7	0.986	-0.12	4.88	3.07	52	0.566	-4.94	0.06	1.01
8	0.984	-0.14	4.86	3.06	53	0.549	-5.21	-0.21	0.95
9	0.982	-0.16	4.84	3.05	54	0.532	-5.48	-0.48	0.90
10	0.980	-0.18	4.82	3.04	55	0.515	-5.76	-0.76	0.84
11	0.974	-0.23	4.77	3.00	56	0.494	-6.13	-1.13	0.77
12	0.968	-0.28	4.72	2.96	57	0.473	-6.50	-1.50	0.71
13	0.962	-0.34	4.66	2.93	58	0.452	-6.90	-1.90	0.65
14	0.956	-0.39	4.61	2.89	59	0.431	-7.31	-2.31	0.59
15	0.950	-0.45	4.55	2.85	60	0.410	-7.74	-2.74	0.53
16	0.944	-0.50	4.50	2.82	61	0.389	-8.20	-3.20	0.48
17	0.939	-0.55	4.45	2.79	62	0.368	-8.68	-3.68	0.43
18	0.933	-0.60	4.40	2.76	63	0.347	-9.19	-4.19	0.38
19	0.928	-0.65	4.35	2.72	64	0.326	-9.74	-4.74	0.34
20	0.923	-0.70	4.30	2.69	65	0.305	-10.31	-5.31	0.29
21	0.914	-0.78	4.22	2.64	66	0.281	-11.03	-6.03	0.25
22	0.906	-0.85	4.15	2.60	67	0.257	-11.80	-6.80	0.21
23	0.898	-0.93	4.07	2.55	68	0.233	-12.65	-7.65	0.17
24	0.891	-1.01	3.99	2.51	69	0.209	-13.60	-8.60	0.14
25	0.883	-1.09	3.91	2.46	70	0.185	-14.66	-9.66	0.11
26	0.874	-1.17	3.83	2.42	71	0.164	-15.70	-10.70	0.09
27	0.865	-1.25	3.75	2.37	72	0.143	-16.89	-11.89	0.06
28	0.857	-1.34	3.66	2.32	73	0.122	-18.27	-13.27	0.05
29	0.849	-1.43	3.57	2.28	74	0.101	-19.91	-14.91	0.03
30	0.840	-1.51	3.49	2.23	75	0.080	-21.94	-16.94	0.02
31	0.829	-1.63	3.37	2.17	76	0.070	-23.10	-18.10	0.02
32	0.818	-1.74	3.26	2.12	77	0.060	-24.44	-19.44	0.01
33	0.807	-1.86	3.14	2.06	78	0.050	-26.02	-21.02	0.01
34	0.796	-1.98	3.02	2.00	79	0.040	-27.96	-22.96	0.01
35	0.785	-2.10	2.90	1.95	80	0.030	-30.46	-25.46	0.00
36	0.775	-2.21	2.79	1.90	81	0.028	-31.06	-26.06	0.00
37	0.765	-2.33	2.67	1.85	82	0.026	-31.70	-26.70	0.00
38	0.755	-2.44	2.56	1.80	83	0.024	-32.40	-27.40	0.00
39	0.745	-2.56	2.44	1.76	84	0.022	-33.15	-28.15	0.00
40	0.735	-2.67	2.33	1.71	85	0.020	-33.98	-28.98	0.00
41	0.722	-2.82	2.18	1.65	86	0.020	-33.98	-28.98	0.00
42	0.710	-2.97	2.03	1.59	87	0.020	-33.98	-28.98	0.00
43	0.697	-3.13	1.87	1.54	88	0.020	-33.98	-28.98	0.00
44	0.685	-3.29	1.71	1.48	89	0.020	-33.98	-28.98	0.00
					90	0.020	-33.98	-28.98	0.00



NOT TO SCALE

FREQ	DIM. 'A'
88	71" (181 CM)
89	70" (179 CM)
90	70" (177 CM)
91	69" (175 CM)
92	68" (173 CM)
93	67" (171 CM)
94	67" (169 CM)
95	66" (167 CM)
96	65" (166 CM)
97	64" (164 CM)
98	64" (162 CM)
99	63" (160 CM)
100	63" (159 CM)
101	62" (157 CM)
102	61" (156 CM)
103	61" (154 CM)
104	60" (153 CM)
105	60" (151 CM)
106	59" (150 CM)
107	58" (148 CM)
108	58" (147 CM)



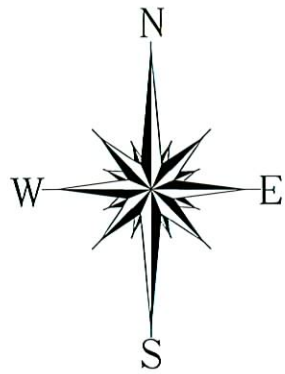
**SCALA**

ELECTRONIC CORPORATION

MEDFORD, OREGON (USA)  
(541) 779-6500  
FAX: (541) 779-3991

## 2CA-2HV ARRAY DIMENSIONS

FM (88-108 MHZ.)

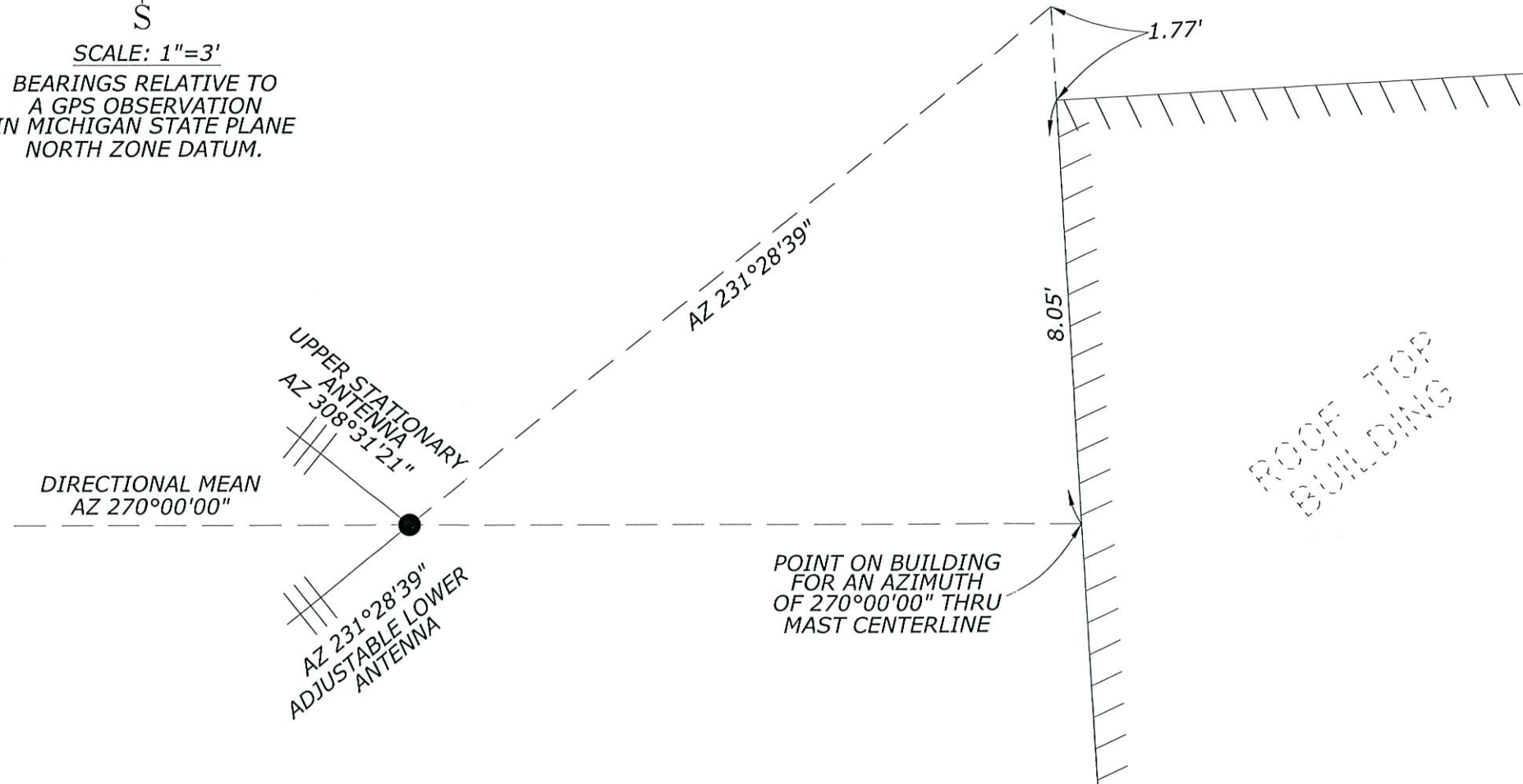


SCALE: 1"=3'

BEARINGS RELATIVE TO  
A GPS OBSERVATION  
IN MICHIGAN STATE PLANE  
NORTH ZONE DATUM.

# Plat of Survey of **WNMU-FM TRANSLATOR** **ON TOP OF HARBOR TOWER APARTMENTS**

City of Escanaba  
Delta County, Michigan



JOB NUMBER	10031-1003
SURVEY FOR	ERIC SMITH
SUBJECT	DIRECTIONAL ANTENNA VERIFICATION
DATE OF SURVEY	MARCH 4, 2010
DATE OF MAPPING	MARCH 4, 2010

CERTIFICATE OF SURVEY TO:

**ERIC SMITH**

I, TERENCE S. WANIC, A PROFESSIONAL SURVEYOR IN THE STATE OF MICHIGAN, HEREBY CERTIFY; THAT I HAVE MADE A SURVEY OF THE ABOVE DESCRIBED LANDS, THAT IRON MONUMENTS, TOGETHER WITH THOSE FOUND HAVE BEEN PLACED OR LOCATED AT THE POSITIONS INDICATED HEREON, THAT THERE ARE NO VISIBLE PHYSICAL ENCROACHMENTS EITHER WAY ACROSS PROPERTY LINES, EXCEPT AS SHOWN, THAT THE RELATIVE ERROR OR CLOSURE OF THE UNADJUSTED FIELD MEASUREMENTS OF THE SURVEY IS LESS THAN THE RATIO OF 1 PART IN 10,000.

*Terence S. Wanic 3/4/10*

TERENCE S. WANIC, Professional Surveyor No. 44296

**ORIGINAL**



1410 Ludington Street  
Escanaba, Michigan 49829  
Phone (906)786-1755,  
Fax 786-6487

LAND SURVEYORS, P.C.

## LEGEND

- - - INDICATES A LINE NOT DRAWN TO SCALE
- IRON MONUMENTS SET
- IRON MONUMENTS FOUND
- CONC. MONUMENTS SET
- CONC. MONUMENTS FOUND
- ⊕ CHISELED CROSS IN CONCRETE
- (M) MEASURED DISTANCE AND/OR BEARING
- (R) RECORDED DISTANCE AND/OR BEARING
- ⊕ SECTION CONTROL CORNERS

March 4, 2010

Mr. Eric L. Smith  
Director of Broadcast & AV Services  
Northern Michigan University  
1401 Presque Isle Ave.  
Marquette, MI 49855

REFERENCE: W243CQ WNMU-FM TRANSLATOR – DIRECTIONAL ANTENNA  
VERIFICATION

Dear Mr. Smith,

On March 4, 2010, Davis / Wanic Land Surveyors verified that the above referenced translator antenna located at North Latitude 45 deg. 44 min. 43 sec., West Longitude 087 deg. 03 min. 14 sec. is correctly positioned with the main lobe adjusted to a true azimuth of 270° 00'00". These measurements were made by GPS observation in the Michigan State Plane North Zone datum.

If you have any questions concerning this information, please feel free to contact me.

Respectfully Submitted,



Terence S. Wanic  
MI P.S. # 44296  
WI P.S. #2892



To: Eric Smith, General Manager

From: Mike Perucco, Acting Chief Transmitter Engineer *Michael Perucco*

Date: March 3, 2010

Reference: **ESCANABA TRANSLATOR ANTENNA INSTALLATION**

This is to inform you that WNMU engineers today, completed the installation of the Scala antenna (model CA-4 70 degree skew, two-bay dipole reflector array) for our translator operation in Escanaba, MI. The antenna has been properly installed in accordance with the manufacturer's instructions and tuned to the 96.5Mhz frequency assigned to this transmitter.

We have also completed the survey work necessary to assure that our antenna is aimed at 270 degrees true and now await word from you that all the necessary paperwork has been filed to permit operation of this new facility.

If you have any questions, please let me know.



Broadcast & Audio-Visual Services  
1401 Presque Isle Avenue  
Marquette, MI 49855

To: Mr. John Browne, Principal  
John F. X. Browne & Associates

From: Eric Smith, General Manager

Date: March 8, 2010

Reference: **ENGINEERING CREDENTIALS – MICHAEL PERUCCO**

In response to your request for the credentials of our transmitter engineer who has certified that the Escanaba translator antenna has been installed in accordance with the manufacturer's directions, Mr. Perucco is a graduate of RETS school of electronics and has been employed as an RF, video and audio maintenance engineer at WNMU-TV/FM for 34 years. In addition, Mr. Perucco has successfully completed additional course work covering transmitter maintenance and repair through specialized classes sponsored by RCA and Thales and Harris. His training and extensive work experience makes him well qualified to perform the antenna work associated with his project.