



**COMMUNICATION TECHNOLOGY**

Proposal Number	<b>C-05208</b>
Date	<b>8/6/2013</b>
Call Letters	<b>WBMW</b>
Location	<b>Ledyard, CT</b>
Customer	<b>Redwolf</b>
Antenna Type	<b>DCRM4E50RP</b>
Frequency	<b>106.5</b>
Drawing #	<b>20</b>

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## PATTERN CERTIFICATION

### Method of Measurement

The azimuth pattern for WBMW, Dielectric Document Sketch #20, was measured in the following manner.

A single 4.4 to 1 scale model "DCRM4E50RP" bay radiator was mounted on a similarly scaled model of the tower according to information provided to Dielectric by the customer; refer to Dielectric Document Sketch #20. The antenna under test, all parasitics, all known tower appurtenances, and the tower section were rotated through 360 degrees while receiving a signal at the appropriate frequency from a linear cavity-backed source antenna. Both the horizontal and vertical polarization azimuth patterns were measured in an anechoic test range.

The transmit and scale model antennas are mounted at identical elevations and at opposite ends of the chamber. A Hewlett Packard model 8752C network analyzer was used to supply the RF signal to the source antenna at 4.4 times the fundamental FM frequency and to receive the signal intercepted by the antenna under test. The received signal was converted to a relative level, referenced to the source. This level was stored on a computer acting as the master controller. The computer controls the measurement system via IEEE-488 control bus through a GPIB card.

### Statement of Qualifications

Jon Hanson is an Electrical Engineer here at Dielectric. He received a BS in Electrical Engineering from the North Dakota State University in 2004. He has 6 years experience in RF antenna engineering and has been employed by Dielectric Communications since 2008.

Signed by: Jon Hanson

**Jon Hanson**

Digitally signed by Jon Hanson  
 DN: CN=Jon Hanson, O=SPX Corporation,  
 OU=SPX Communication Technologies,  
 E=jon.hanson@spx.com, C=US  
 Reason: I am the author of this document  
 Location:  
 Date: 2013/08/06 14:42:57 -05'00'

Date: \_\_\_\_\_



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## **FM AZIMUTH PATTERN APPROVAL**

The azimuth pattern of the horizontal polarization and vertical polarization as supplied by Dielectric in the document labeled "Pattern 20", is acknowledged as acceptable. We understand that Dielectric does not guarantee or predict signal strength in any particular location.

\_\_\_\_\_  
(Customer's name)

By: \_\_\_\_\_  
(Name typed or printed)

Title: \_\_\_\_\_

\_\_\_\_\_  
(Signature)



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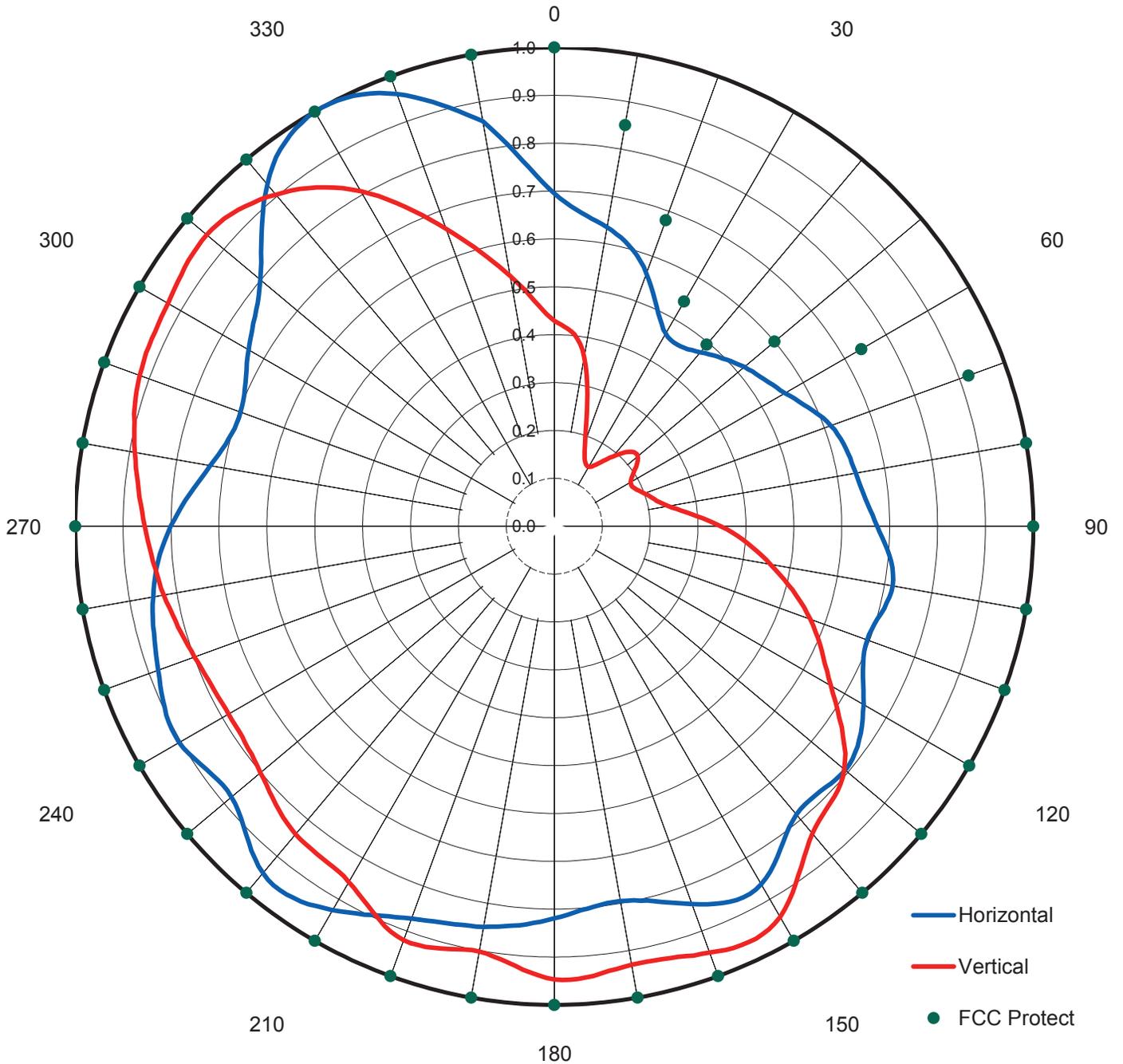
## AZIMUTH PATTERN

86% Ccov 51.9% Hrms - 48.1% Vrms

Gain **1.66 (2.20 dB) HPOL**  
**1.78 (2.51 dB) VPOL**

Calculated / Measured

**Measured**





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 Frequency **106.5**  
 Drawing # **20**

**TABULATION OF HORIZONTAL AZIMUTH PATTERN**

Angle	Field	dBk	ERP kW
	0.695	7.809	6.038
10	0.634	7.011	5.024
20	0.562	5.964	3.948
30	0.465	4.318	2.703
40	0.474	4.485	2.808
50	0.518	5.256	3.354
60	0.556	5.871	3.864
70	0.614	6.732	4.712
80	0.639	7.079	5.104
90	0.674	7.542	5.678
100	0.717	8.079	6.426
110	0.695	7.809	6.038
120	0.746	8.424	6.956
130	0.793	8.955	7.861
140	0.786	8.878	7.722
150	0.864	9.699	9.331
160	0.840	9.455	8.820
170	0.795	8.976	7.900
180	0.819	9.235	8.385
190	0.850	9.557	9.031
200	0.872	9.779	9.505
210	0.926	10.301	10.718
220	0.946	10.487	11.186
230	0.880	9.859	9.680
240	0.904	10.092	10.215
250	0.880	9.859	9.680
260	0.850	9.557	9.031
270	0.801	9.042	8.020
280	0.729	8.224	6.643
290	0.697	7.834	6.073
300	0.737	8.318	6.790
310	0.801	9.042	8.020
320	0.932	10.357	10.858
330	0.999	10.960	12.475
340	0.961	10.624	11.544
350	0.859	9.649	9.224
Additional Point	331	1.000	10.969



**COMMUNICATION TECHNOLOGY**

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**TABULATION OF VERTICAL AZIMUTH PATTERN**

Angle	Field	dBk	ERP kW
	0.429	3.618	2.301
10	0.359	2.071	1.611
20	0.188	-3.548	0.442
30	0.143	-5.924	0.256
40	0.190	-3.456	0.451
50	0.227	-1.910	0.644
60	0.184	-3.735	0.423
70	0.200	-3.010	0.500
80	0.242	-1.355	0.732
90	0.347	1.776	1.505
100	0.458	4.186	2.622
110	0.569	6.071	4.047
120	0.667	7.452	5.561
130	0.790	8.922	7.801
140	0.838	9.434	8.778
150	0.943	10.459	11.116
160	0.948	10.505	11.234
170	0.930	10.339	10.811
180	0.947	10.496	11.210
190	0.902	10.073	10.170
200	0.920	10.245	10.580
210	0.858	9.639	9.202
220	0.840	9.455	8.820
230	0.801	9.042	8.020
240	0.785	8.866	7.703
250	0.799	9.020	7.980
260	0.828	9.330	8.570
270	0.855	9.608	9.138
280	0.889	9.947	9.879
290	0.921	10.254	10.603
300	0.931	10.348	10.835
310	0.947	10.496	11.210
320	0.904	10.092	10.215
330	0.808	9.117	8.161
340	0.661	7.373	5.462
350	0.531	5.471	3.525

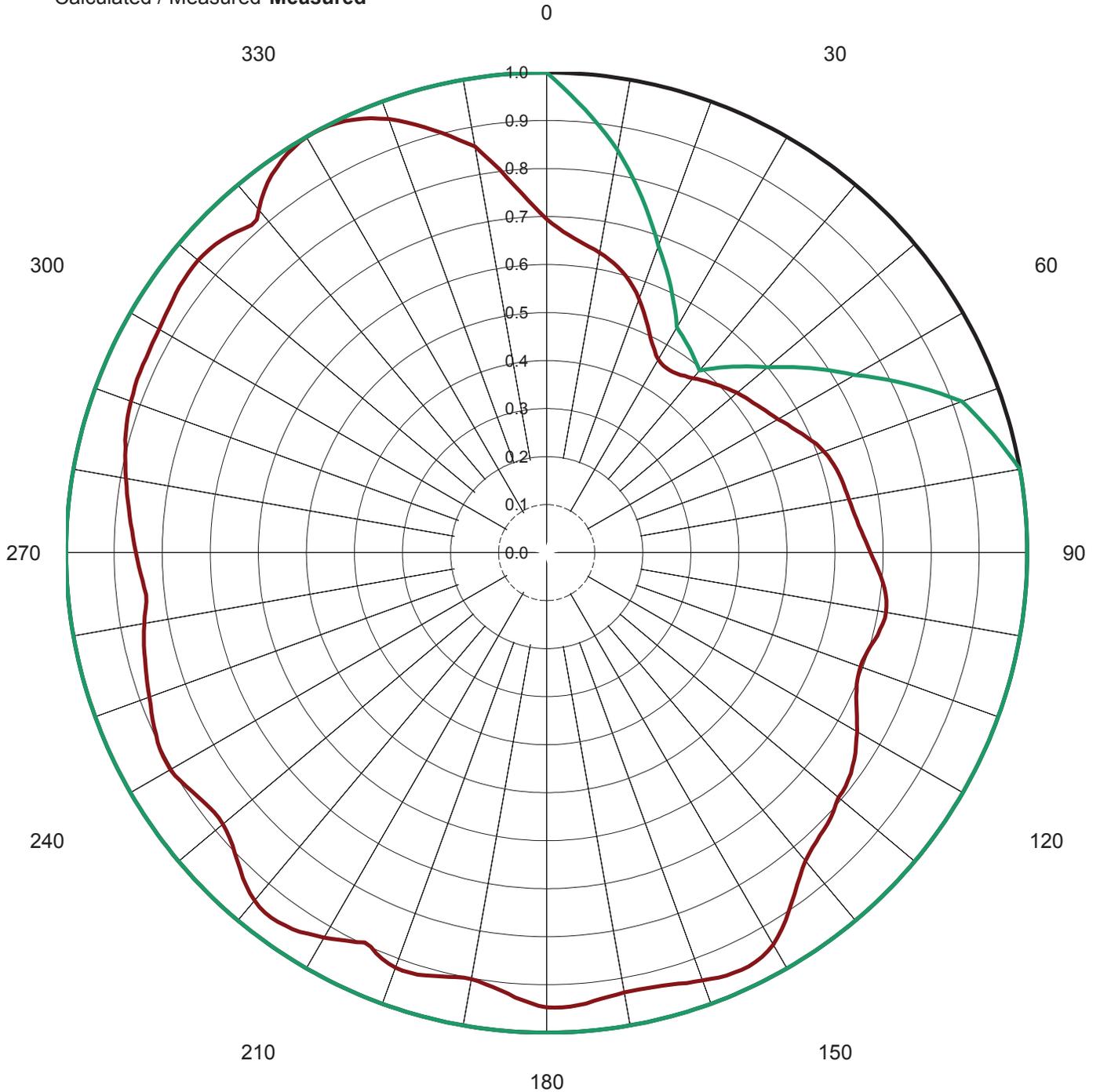


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**COMPOSITE AZIMUTH PATTERN**

Calculated / Measured **Measured**





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**TABULATION OF COMPOSITE AZIMUTH PATTERN**

Angle	Field	dBk	Power kW	Input Power
	0.695	7.809	6.038	12.500
10	0.634	7.011	5.024	12.500
20	0.562	5.964	3.948	12.500
30	0.465	4.318	2.703	12.500
40	0.474	4.485	2.808	12.500
50	0.518	5.256	3.354	12.500
60	0.556	5.871	3.864	12.500
70	0.614	6.732	4.712	12.500
80	0.639	7.079	5.104	12.500
90	0.674	7.542	5.678	12.500
100	0.717	8.079	6.426	12.500
110	0.695	7.809	6.038	12.500
120	0.746	8.424	6.956	12.500
130	0.793	8.955	7.861	12.500
140	0.838	9.434	8.778	12.500
150	0.943	10.459	11.116	12.500
160	0.948	10.505	11.234	12.500
170	0.930	10.339	10.811	12.500
180	0.947	10.496	11.210	12.500
190	0.902	10.073	10.170	12.500
200	0.920	10.245	10.580	12.500
210	0.926	10.301	10.718	12.500
220	0.946	10.487	11.186	12.500
230	0.880	9.859	9.680	12.500
240	0.904	10.092	10.215	12.500
250	0.880	9.859	9.680	12.500
260	0.850	9.557	9.031	12.500
270	0.855	9.608	9.138	12.500
280	0.889	9.947	9.879	12.500
290	0.921	10.254	10.603	12.500
300	0.931	10.348	10.835	12.500
310	0.947	10.496	11.210	12.500
320	0.932	10.357	10.858	12.500
330	0.999	10.960	12.475	12.500
340	0.961	10.624	11.544	12.500
350	0.859	9.649	9.224	12.500
Additional Point 331	1.000	10.969	12.500	12.500



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### **CUSTOMER GAIN SUMMARY**

Azimuth Pattern Gain of Horizontal Polarization	1.66 (2.20 dB)
Elevation Pattern Gain Per Polarization	2.14 (3.29 dB)
Peak Gain of Horizontal Polarization	3.54 (5.49 dB)



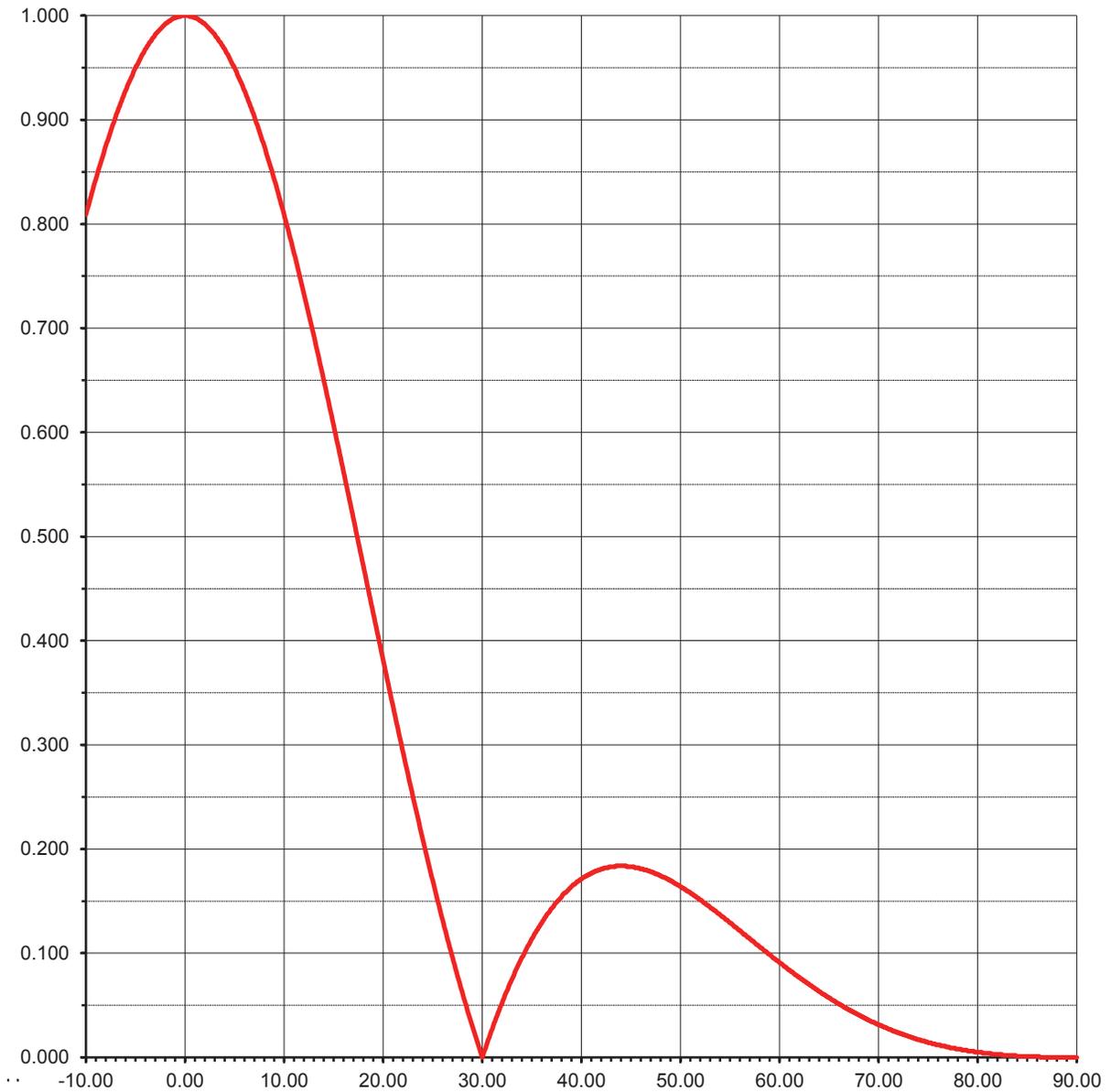
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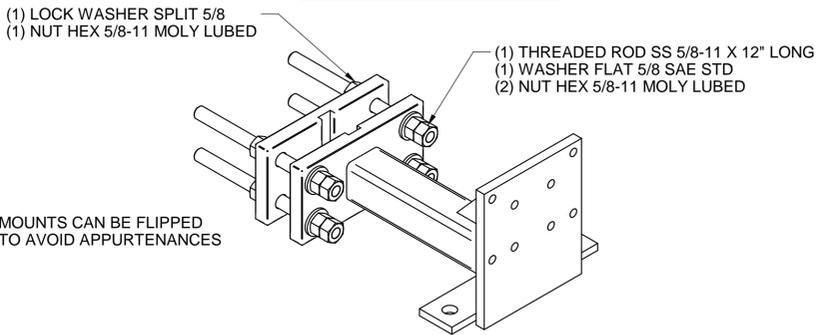
### ELEVATION PATTERN

RMS Gain at Main Lobe **2.14 ( 3.29 dB )**  
Per Polarization  
Calculated / Measured **Calculated**

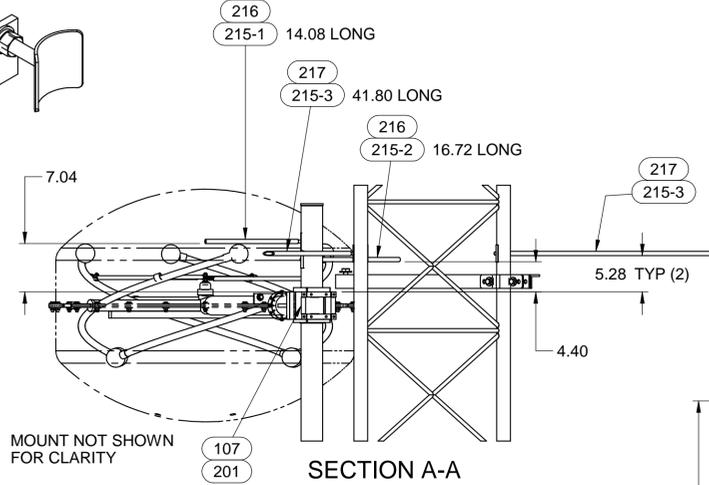
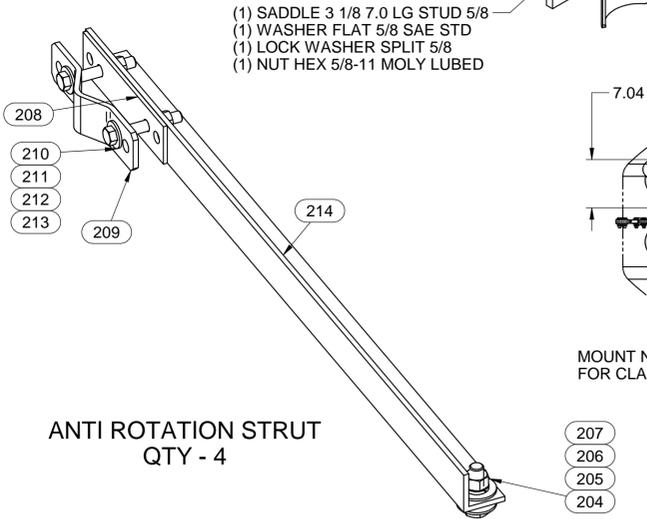
Beam Tilt  
Frequency **106.5 MHz**



# ITEM 203 DETAIL



# ITEM 202 DETAIL



TYP BAYS 1-4

ANTENNA BOM				
ITEM NO	MATERIAL	MATERIAL DESCRIPTION	REQ'D QTY	UNIT
101	R004A37801	DCR-M ANTENNA W/ RADOME	2	EA
102	R56545	JCT BLK CENTER ASSY DCRM & SKH	3	EA
103	R56737	JCT BLK END ASSY DCRM & SKH	1	EA
104	R0044841501	ICE SHIELD KIT T/L 3-50 FM ANT	1	EA
105	R56569	F/L INPUT SECT 3-50 x 70"	1	EA
106	RTL3FMSQFLG	T/L KIT 3-50 SQ FLANGE FM USE 51.413" LONG	3	EA
107	R59164	STAND-OFF MOUNT SS STL FM ANT	8	EA
108	R71106	AFM 3-50 FM SHORT-STUB 53"	1	EA
109	11000007987	DCR-M ANTENNA W/RADOME HALF WAVE	2	EA
MOUNT BOM				
ITEM NO	MATERIAL	MATERIAL DESCRIPTION	REQ'D QTY	UNIT
201	11000005999	HARDWARE BLOCK MOUNTING KIT	4	EA
202	11000006195	MOUNT TERMINATION FM STD FOR 3-50	2	EA
203	11000006196	MOUNT KIT FM ANTENNA BAY	4	EA
204	R0426300000	WASHER FLAT 5/8 SAE STD	8	EA
205	R0166300000	LOCK WASHER SPLIT 5/8	4	EA
206	R0146311000	NUT HEX 5/8-11 MOLY LUBED	4	EA
207	R0026311200	HHCS SS 5/8-11x2.00	4	EA
208	R002A80601	ANTI-ROTATION REINFORCEMENT PLATE	4	EA
209	R84381	CLAMPING BAR	4	EA
210	R0025013300	HHCS SS 1/2-13x3.00	8	EA
211	R0425000000	WASHER FLAT 1/2 SAE STD	16	EA
212	R0165000000	LOCK WASHER SPLIT 1/2	8	EA
213	R0145013000	NUT HEX 1/2-13 MOLY LUBED	8	EA
214	10000009351	016A54204 ANTI-ROTATION STRUT W/BMW 106.5	4	EA
215-1	10000009350	016A54202 PARASITIC 14.08 LONG ITEM 215-1	4	EA
215-2	10000009350	016A54202 PARASITIC 16.72 LONG ITEM 215-2	4	EA
215-3	10000009350	016A54202 PARASITIC 41.80 LONG ITEM 215-3	8	EA
216	R0002187015	HOSE CLAMP 3.06 - 4.00 DIA	16	EA
217	R0002187010	HOSE CLAMP 1.81 - 2.75 DIA	16	EA
218	R102895	TOP BAY 12 3-50 EXTENSION	1	EA

### INSTALLATION NOTES:

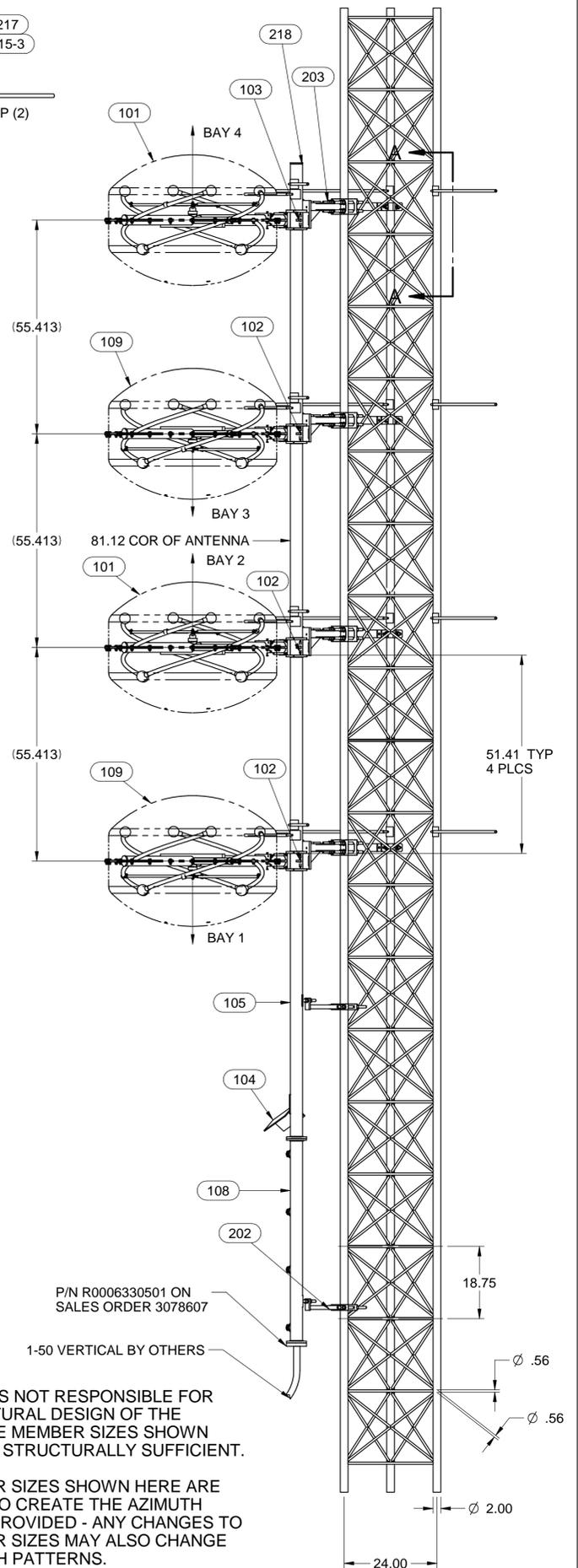
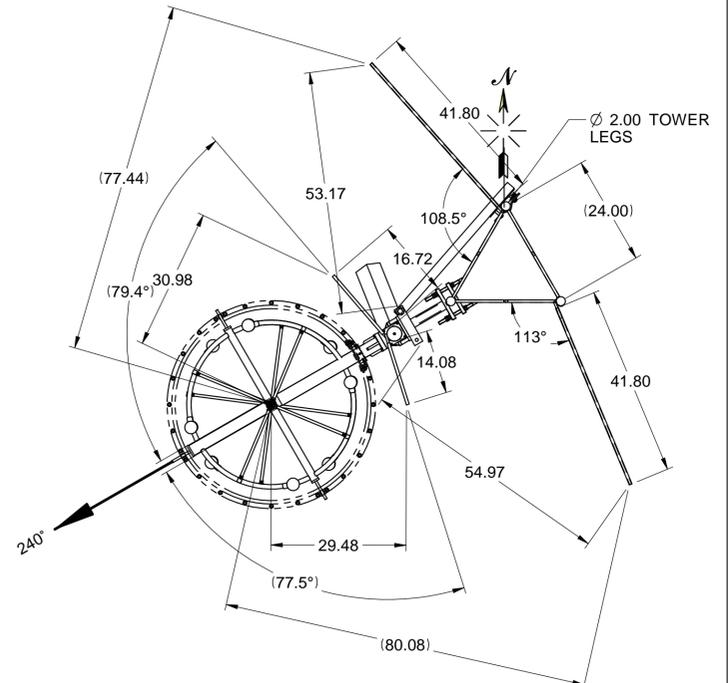
- ANTENNA SHALL BE INSTALLED PER THIS INSTALLATION DRAWING. ANY DEVIATIONS WILL VOID WARRANTY UNLESS APPROVED BY SPX COMMUNICATIONS TECHNOLOGIES.
- TO ACHIEVE ANY GIVEN PATTERN STUDY PERFORMED BY SPX COMMUNICATIONS TECHNOLOGIES, THE PROVIDED ANTENNA MUST BE INSTALLED AND ORIENTED AS DEPICTED IN THIS DRAWING. IF ANY SUCH PATTERN WAS NOT PROVIDED, THE ANTENNA ORIENTATION AND POSITION IS AT THE DISCRETION OF THE BUYER TO WHICH THE ANTENNA WAS SOLD. SHOULD ANY QUESTIONS ARISE DURING THE INSTALLATION PROCESS, CONTACT SPX COMMUNICATIONS TECHNOLOGIES AT, 1-800-341-9678, TO ASSIST IN THIS PROCESS; BE PREPARED TO PROVIDE THE PART NUMBER OR DRAWING NUMBER SHOWN BELOW.
- COMPONENTS ARE MATCH MARKED FOR EASE IN ASSEMBLY.
- ITEM NUMBERS DEPICTED ON THIS DRAWING CORRESPOND TO ITEM NUMBERS LISTED ON ENCLOSED BILL OF MATERIAL.
- APPLY THIN LAYER OF DC4 DOW CORNING COMPOUND TO ALL "O"-RING SEALS PRIOR TO ASSEMBLY.
- UNLESS OTHERWISE SPECIFIED, THE TOP BAY MUST NOT BE LOCATED ANY CLOSER THAN 5 ft. BELOW THE TOWER TOP.
- BAY TAP POINT DIRECTION INDICATED BY ARROWS LOCATED IN THE BAY IN ELEVATION VIEW.
- THE VARIABLE TRANSFORMER IS SHIPPED WITH ALL PROBES FULLY INSERTED. AT INSTALLATION, BE CERTAIN TO LOOSEN LOCKNUTS AND PULL ALL PROBES TO FULL OUTWARD POSITION. ALL PROBES MUST BE IN FULL OUTWARD POSITION BEFORE POWERING UP ANTENNA. REFER TO INSTRUCTION MANUAL FOR TUNING INSTRUCTIONS.
- SUGGESTED LOCATION FOR TERMINATION MOUNT. LOCATION MAY VARY PER TOWER DESIGN.
- FOR HEATED ANTENNAS ONLY: HEATER HARNESS TO BE DRESSED AND SECURED TO TOWER PER INSTALLERS DISCRETION. LOOSE OR DANGLING WIRE IN RF FIELD WILL SHORT AND RESULT IN ANTENNA FAILURE.
- REFER TO DRAWING A88212 FOR ALL HARDWARE TORQUE SPECIFICATIONS. \* FOR FIBERGLASS APPLICATIONS, TORQUE MOUNTING HARDWARE TO 180 in-lbs (15 ft-lbs)
- IT IS IMPORTANT TO MAINTAIN DOCUMENT FOR HISTORICAL PURPOSES. THE MOST CRITICAL PORTION OF INFORMATION TO BE MAINTAINED IS THE PART NUMBER AS SPECIFIED.
- AFTER ANTENNA HAS BEEN INSTALLED AND TUNED ON THE TOWER, IT IS REQUESTED THAT A COPY OF THE TEST DATA BE FORWARDED TO:

SPX COMMUNICATIONS TECHNOLOGIES  
C/O FM ENGINEERING MANAGER  
22 TOWER RD. RAYMOND, ME. 04071  
PHONE 1 - 800 - 341 - 9678

COMPANY CONFIDENTIAL: INFORMATION CONTAINED HEREIN IS CONFIDENTIAL. IT IS THE PROPERTY OF SPX CORPORATION. IT IS TO BE USED SOLELY FOR THE PURPOSE PROVIDED, AND IT IS NOT TO BE DISCLOSED TO OTHERS WITHOUT THE PRIOR WRITTEN CONSENT OF SPX CORPORATION.

UNLESS OTHERWISE SPECIFIED  
MANUFACTURING TOLERANCE AND PROCEDURES MUST BE IN ACCORDANCE WITH D78691. ALL ALUMINUM, COPPER, AND BRASS WELDING MUST COMPLY WITH A-82700, SECT. XIV "PRODUCTION WELDING PROCEDURES". STRUCTURAL STEEL WELDING MUST COMPLY WITH "AWS 1.1 CURRENT REVISION".

REV:	SHEET:	ZONE:	REVISION NOTE	ECO	DATE APPR
B			CAD MAINTAINED. CHANGES SHALL BE INCORPORATED BY THE DESIGN ACTIVITY. LEG SIZE OF TOWER CHANGED FOR Ø1.25 TO Ø2.00	9402	3/18/2013



NOTE: SPX IS NOT RESPONSIBLE FOR THE STRUCTURAL DESIGN OF THE TOWER - THE MEMBER SIZES SHOWN MAY NOT BE STRUCTURALLY SUFFICIENT.

THE MEMBER SIZES SHOWN HERE ARE REQUIRED TO CREATE THE AZIMUTH PATTERNS PROVIDED - ANY CHANGES TO THE MEMBER SIZES MAY ALSO CHANGE THE AZIMUTH PATTERNS.

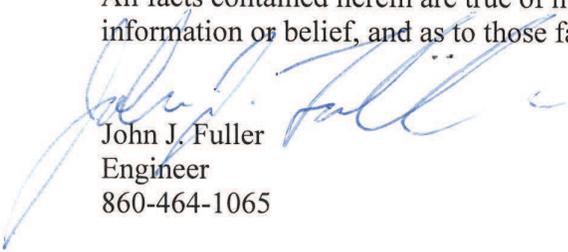
STATUS: <b>RELEASED</b>	DIMENSIONAL TOLERANCES (UNLESS OTHERWISE NOTED) DECIMAL DIMENSIONS 3 PLACE DIMENSIONS ±.005 2 PLACE DIMENSIONS ±.02 FRACTIONAL DIMENSIONS 0" - 6" UP TO 12" ±1/16" ABOVE 12" UP TO 48" ±1/8" ABOVE 48" ±1/4" ANGULAR DIMENSIONS ±1/2" REFERENCE DIMENSIONS ARE NOT FOR MANUFACTURING OR INSPECTION	 Raymond, ME TITLE: <b>INSTALLATION</b> DCRM4E50RP BMWW 106.5 FM PROJECT# C-05208 SO 3078607													
PART NO: / MATERIAL NO:	<table border="1"> <tr><th>NAME</th><th>DATE</th></tr> <tr><td>DESIGNED BY r_mason_c</td><td>3/18/2013</td></tr> <tr><td>DETAIL BY r_mason_c</td><td>3/18/2013</td></tr> <tr><td>CHKD BY j_ackc</td><td>3/18/2013</td></tr> <tr><td>ENG. 1 APPR. Ricks</td><td>3/18/2013</td></tr> <tr><td>ENG. 2 APPR. KeithP</td><td>3/18/2013</td></tr> <tr><td>MANUFACT. RustyW</td><td>3/18/2013</td></tr> </table>		NAME	DATE	DESIGNED BY r_mason_c	3/18/2013	DETAIL BY r_mason_c	3/18/2013	CHKD BY j_ackc	3/18/2013	ENG. 1 APPR. Ricks	3/18/2013	ENG. 2 APPR. KeithP	3/18/2013	MANUFACT. RustyW
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ENG. 1 APPR. Ricks	3/18/2013														
ENG. 2 APPR. KeithP	3/18/2013														
MANUFACT. RustyW	3/18/2013														
SAP DOCUMENT NO: <b>10000009349</b>	ANGLE PROJECTION 	GAGE CODE <b>D 08441 016A54200</b>													
MATERIAL:	FINISH: REFER TO D8110 FOR PLATING REFER TO D17800 FOR PAINT	DRAWING NO: 10:57:38 AM SHEET: 1 OF 1													

**DECLARATION CONCERNING THE INSTALLATION ON  
WBMW-FM DIRECTIONAL FM**

I, John Fuller, the engineer for WBMW-FM, having personally observed the assembly, installation and orientation of the directional antenna system do hereby certify that all instructions of the manufacturer (SPX) were completely followed. I am familiar with the FCC rules and the standards of good engineering practice and certify that the installation is in compliance with such.

During the installation and during subsequent operation of the joint FM facilities, I certify that no one was exposed to excess levels of RF energy. The tower has a locked gate and appropriate warning signs are posted.

All facts contained herein are true of my own knowledge except where stated to be on information or belief, and as to those facts, I believe them to be true.

  
John J. Fuller  
Engineer  
860-464-1065

Executed on the 19 day of July 2013

*D. Frenier*  
*my com exp. 5/31/14*



**MATTERN & STEFON**  
LAND SURVEYORS

148 Route 2 · Preston, Connecticut 06365  
Phone: (860) 889-1999 · Fax: (860) 383-2524

---

Susan F. Mattern, L.S. · Gerald J. Stefon, L.S. · Jeffrey S. Greiner, L.S.

August 14, 2013

John Fuller  
Red Wolf Broadcasting, Corp.  
P.O. Box 357  
Ledyard, Connecticut 06339

**RE: Wireless Telecommunications Facility  
Antenna Placement for WBMW Station  
Job No.: 11-0206  
Location: 581 Colonel Ledyard Highway, Ledyard, Connecticut  
Assessor's Parcel: 84-530-581**

Dear Mr. Fuller:

This is to certify that on June 17, 2013, our survey crew worked with the crew from Northeast Towers of Farmington, Connecticut to place a reference stake for the orientation of the WBMW antenna at the above noted site. The stake was oriented to true north based upon the plan specification of two hundred forty degrees (240°), or S 60° W as depicted on the following plan:

"TITLE: INSTALLATION DCRM4E50RP WBMW 106.5 FM, PROJECT # C-05208 SO 3078607, D, GAGE CODE: 08441, DRAWING NO.: 016A54200, 1:21:41 PM, SHEET 1 OF 1, STATUS: RELEASED, SAP DOCUMENT NO.: 10000009349, FINISH: REFER TO D8110 FOR PLATING, REFER TO D17800 FOR PAINT, DESIGNED BY mason\_c 3/12/13, DETAIL BY mason\_c 3/12/13, CHKD. BY JackC 3/11/13, ENG.1 APPR. RickS 3/11/13, ENG.2 APPR. KeithP 3/11/13, MANUFACT. RustyW 3/12/13", Prepared by SPX Communication Technologies, Raymond, ME.

Reference may be made to Connecticut Geodetic Survey Station 2114, Elevation 275.93 1988 North American Datum (NAVD88) recovered and occupied on 12-16-11 to verify the accuracy of our GPS equipment (Carlson GPS - 702-GG antenna, Carlson Surveyor and data collector, Accuracy: 1cm and 1ppm, 0.03 m/s RMS).

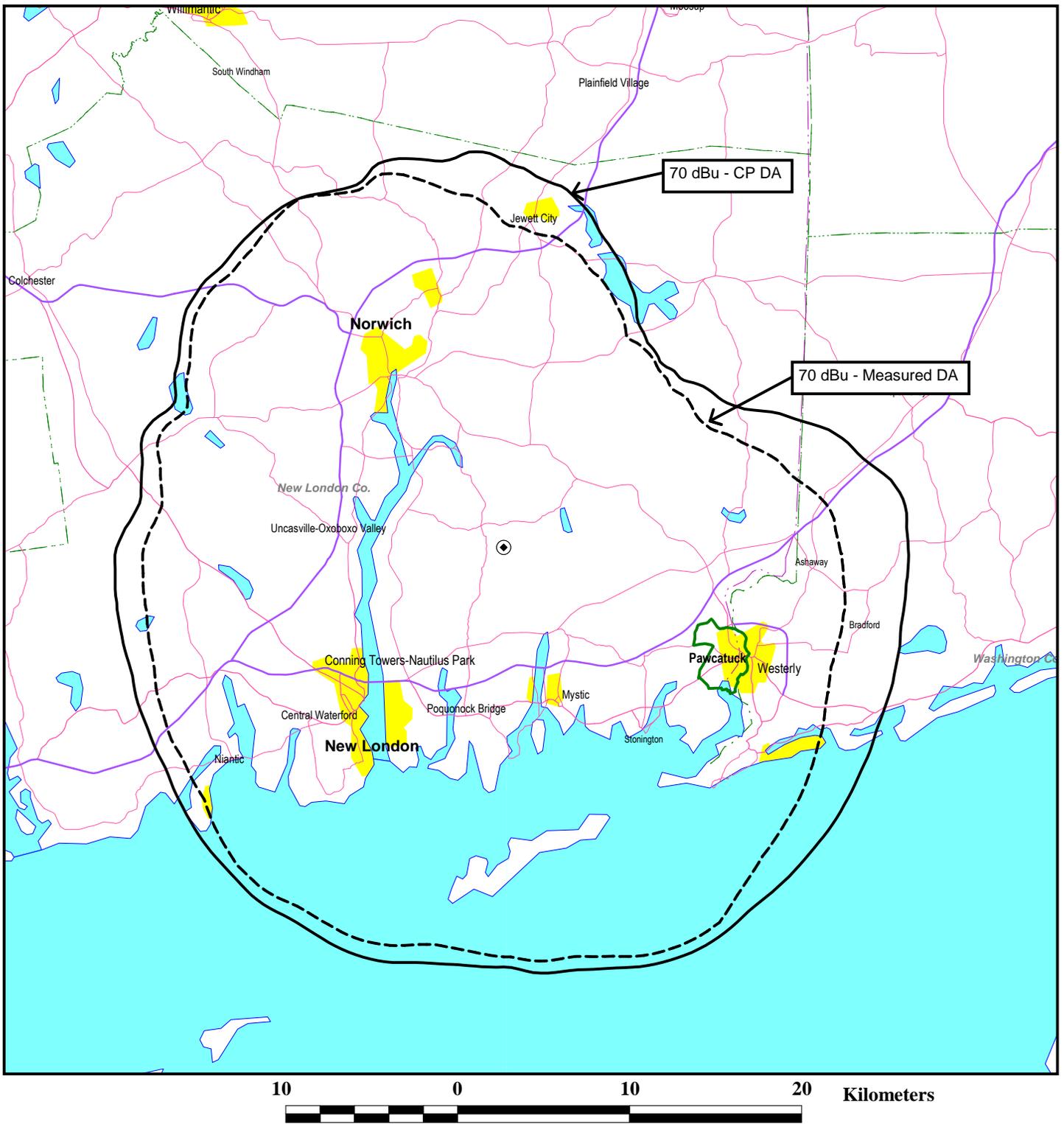
Survey coordinates are based on 1983 North American Datum (NAD 83/87) or Grid North. True North is located 1°57" east of Grid North as per U.S. Geological Survey Quadrangle Map #87 for Uncasville, Conn. Said Map indicated that Magnetic North is located 14 1/2° west of True North. Based on the approximate Latitude and Longitude values we had for the site, we visited the U.S. Department of Commerce National Oceanic and Atmospheric Administration website, and determined a more accurate declination angle from True North to Magnetic North, that being 14°14'37" West. Field equipment utilized on site included a Total Station - Topcon GTS 311, maximum range: 3,300' (miniprism), 8,900' (1 prism), 11,800' (2 prisms), 14,400' (9 prisms), measurement accuracy:  $\pm$  2mm+2ppm, angular accuracy: 2" and a Suunto Compass KB-14/360Q, accuracy: 1/3°.

If you should have any questions concerning this information, please do not hesitate to contact me.

Sincerely,

Susan F. Mattern, L.S.

Figure 1



**COMPLIANCE WITH SECTION 73.315**

STATION WBMW  
PAWCATUCK, CONNECTICUT  
CH 293B1 12.5 KW (DA) 141 M

du Treil, Lundin & Rackley, Inc. Sarasota, Florida