



## ***Propagation Systems, Inc.***

Quality Broadcast Antenna Systems

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**Directional FM Antenna  
WTBK  
Manchester Communications, Inc.  
Manchester, KY**

A standard model PSIFM antenna with parasitic element was used in conjunction with the customer's 37" face tower to create the necessary directional radiation pattern. The final antenna consists of three radiating elements each secured to the tower with a custom-mounting bracket. The antenna bays are full wave spaced and there are a total of three horizontal parasitic elements. The antenna array is fed from a 1-5/8" rigid inter-bay transmission line, which distributes equal power and phase to each radiating element.

Pattern testing was performed using a 1/3 scale model element and tower. The azimuth plane measurements were taken on a ground reflection test range. This type of test range utilizes the reflected signal and direct signal from the source antenna to form an interference pattern on the antenna under test. The antenna and tower structure under test was mounted to a turntable that allowed the structure to be rotated 360° in the azimuth plane. The source antenna was located approximately 75 ft. from the antenna under test. The source height above ground was adjusted to peak the first lobe of the interference pattern at the antenna under test.

The test antenna was mounted in the center of rotation of the turntable. The antenna and mounting structure were rotated clockwise while data was recorded in a counter clockwise direction. All feed cables to the antenna were secured and grounded during pattern measurements. A Hewlett Packard 8753A-network analyzer operating at 317.1 MHz was used as both the source and receiver. The level of the received signal was compared with a standard dipole to establish the directivity of the final pattern. The final pattern measured does not exceed the envelope pattern and is greater than 85% of the envelope RMS.

The antenna is to be mounted to the northwest tower face and positioned 327 degrees as shown in drawing J1203FM-384-001. The antenna center of radiation per the construction permit is to be 107 meters above ground level. No other antenna can be installed within 15 ft of any radiating element. It is recommended that a broadcast engineer is present to supervise the installation of the antenna and that he or she certifies the antenna has been installed according to the enclosed instructions.

An input power level of 2.22 kW will be required at the antenna input in order to reach the licensed 5 kW ERP. The transmitter output power requirements are dependent upon the transmission line size and length used to feed the antenna.

### Antenna Specifications

Antenna Model	PSIFM-3-DA
Type	3-bay directional FM antenna
Frequency	105.7 MHz
Polarization	Circular
Envelope RMS	.899
Gain (h-pol)	2.25 (3.52 dB)
RMS (h-pol)	.78
Gain (v-pol)	2.20 (3.42 dB)
RMS (v-pol)	.75
RMS Composite	.81
Input	1-5/8" EIA end fed input
Power rating	12 kW
Length	30 ft. 1-1/4 in.
Weight	150 lbs.

### Statement of Certification

This is to certify the antenna has been designed, fabricated and tested under my supervision and it meets the required envelope pattern limitations set forth in the stations construction permit.



Douglas A. Ross  
President

2.22 kW + transmitter loss = all transmission line loss

370  
for  
ft  
Transmission Line  
Total Loss  
= .78225 dB  
+ .00155  
for 3 ft + 1/4  
= 78225 dB

## Uncrating

When uncrating the antenna system, open each crate carefully so that the crates may be used to return any merchandise that may have been damaged in shipping. Separate all parts and confirm that all items on the packing list have been received. If any parts are missing, notify PSI or its agent prior to assembling the antenna. If any parts are damaged through shipment or are missing, **promptly** notify the shipping carrier.

## General Notes

1. Review antenna elevation and plan the installation. The antenna brackets have been designed for tower face mount.
2. All bays are to be aligned to the same azimuth angle.
3. Exercise care when assembling the inner conductors of the coaxial line. The bullet should fit firmly in the inner conductor in order to assure a proper connection.
4. The feed points are in the up position.
5. Install one bay/inter-bay assembly at a time.
6. Keep all transmission lines free from dirt and moisture. All Teflon insulators must be clean and dry.
7. The antenna requires pressurization.
8. The antenna has been tuned at the factory and should not require field adjustment.
9. The antenna system should be tested before the erector leaves the premises to insure that the complete antenna system is functioning properly.

## Installation Instructions

### Step One

Review the enclosed drawings and read all steps for a general overview of the antenna installation. Starting with bay one, attach the radiating element to inter-bay one using the supplied O-ring and 5/16-18 x 7/8" bolts and lock washers. Next attach a bay bracket to the horizontal boom of the radiating element using the supplied #28 hose clamps. The top bay (element one) is to be mounted 366 ft. above ground level or 18.8 ft. below the top guy point. The element must be positioned 327 degrees true which is perpendicular to the northwest tower face. Next attach bay one parasitic element to the inter-bay block directly behind the antenna element using the supplied 5/16-18 x 7/8" bolts and locks. The orientation of the parasitic element must be position with the red band as shown in drawing J1203FM-384-001. The element feed point must be positioned with the Teflon insulator up. Hoist bay one/inter-bay one and attach secure to the tower face with the supplied 3 8-16 x 3-9/16" ID U-bolts. **Use caution when erecting the assembly. The inter-bay inner conductor is not captivated. Secure the inner conductor before hoisting the assembly.**

### Step Two

Follow the same procedure for bay two. Attach bay two to it's corresponding inter-bay, attach the bay bracket and parasitic element. Connect bay two/inter-bay assembly to inter-bay one using the supplied O-ring and 5/16-18 x 7/8" bolts and lock washers. Use caution not to split the anchor insulator connector when assembling the 1-5/8" line sections. **Use caution when erecting the assembly. The inter-bay inner conductor is not captivated. Secure the inner conductor before hoisting the assembly.** The element feed point must be positioned with the Teflon insulator up.

### Step Three

Follow the same procedure for bay three. Inter-bay three has been shipped pre-assembled to the input fine matcher. Attach the tuner bracket between probes 2 and 3. Hoist bay three assembly and connect with bay two.

### Step Four

**Check all bolted connections for tightness.** Connect the main transmission line to the antenna input located at the base of the fine matcher. **Do not allow the weight of the feed line to be supported by antenna.** The antenna system should be tested before the erector leaves the premises to insure that the complete antenna system is functioning properly. The antenna has been tested and tuned at the factory. It should not require tuning, however the antenna has been supplied with a fine matcher that can be adjusted for optimum VSWR. Consult the factory before making adjustments to the fine matcher. The system should be tested before the tower crew leaves the site. The antenna requires pressurization with dry air or nitrogen to a maximum of 5 psi.

## **Drawing Index**

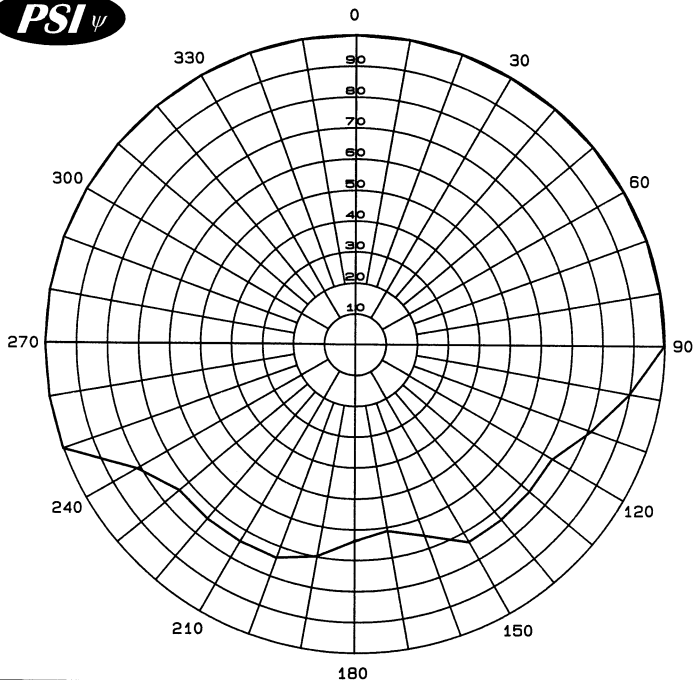
### Drawing Number

J1203FM-384-002  
J1203FM-384-001  
J1203FM-384-018  
J1203FM-384-019  
J1203FM-384-016  
J1203FM-384-007  
J1203FM-384-014  
J1203FM-384-015  
33-00006

### Description

Antenna Elevation  
Antenna Plan View, Orientation  
Bay One and Two Outline  
Bay Three and Tuner Outline  
Parasitic  
End Cap Outline  
Bay Mounting Bracket  
Tuner Mounting Bracket  
Fine Matcher

**PSI**  $\psi$



Maximum Envelope Pattern  
Azimuth Plane  
Antenna: PSIFM-3-DA  
Type: 3-Bay Directional FM  
Polarization: Circular  
Peak ERP: 5 kW (6.99 dBk)  
Frequency: 105.7 MHz  
Station: WTBK Manchester, KY

***Propagation Systems Inc.***  
***PO Box 113***  
***Ebensburg, PA 15931***

# Envelope Pattern

Antenna: PSIFM-3-DA

Manchester Communications, Inc.

Station: WTBK

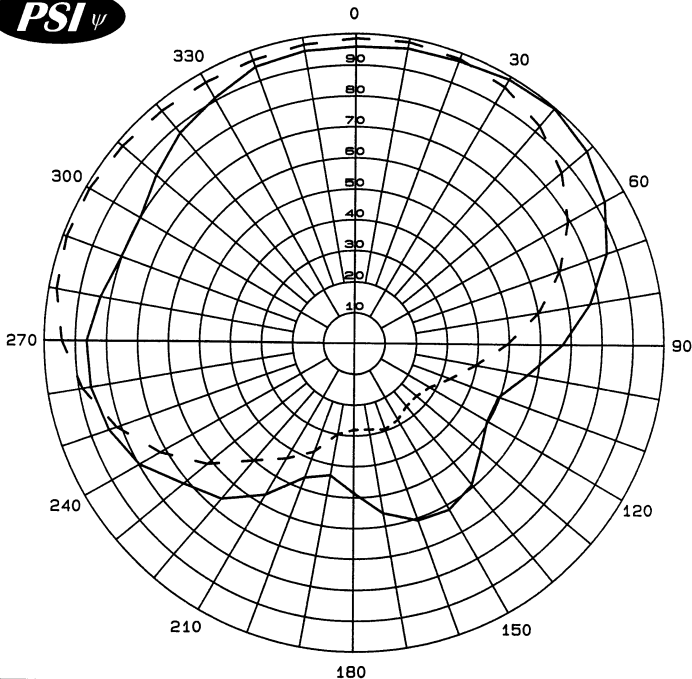
Frequency: 105.7 MHz

Location: Manchester, KY

Maximum ERP: 5 kW ( 6.99 dBk)

Angle	Relative Field	ERP kW	ERP dBK
0	1.000	5.00	6.99
10	1.000	5.00	6.99
20	1.000	5.00	6.99
30	1.000	5.00	6.99
40	1.000	5.00	6.99
50	1.000	5.00	6.99
60	1.000	5.00	6.99
70	1.000	5.00	6.99
80	1.000	5.00	6.99
90	1.000	5.00	6.99
100	0.900	4.05	6.07
110	0.810	3.28	5.16
120	0.735	2.70	4.32
130	0.735	2.70	4.32
140	0.735	2.70	4.32
150	0.736	2.71	4.33
160	0.656	2.15	3.33
170	0.610	1.86	2.70
180	0.636	2.02	3.06
190	0.697	2.43	3.85
200	0.737	2.72	4.34
210	0.738	2.72	4.35
220	0.738	2.72	4.35
230	0.738	2.72	4.35
240	0.810	3.28	5.16
250	1.000	5.00	6.99
260	1.000	5.00	6.99
270	1.000	5.00	6.99
280	1.000	5.00	6.99
290	1.000	5.00	6.99
300	1.000	5.00	6.99
310	1.000	5.00	6.99
320	1.000	5.00	6.99
330	1.000	5.00	6.99
340	1.000	5.00	6.99
350	1.000	5.00	6.99

**PSI**  $\psi$



Measured Relative Field  
Azimuth Plane Pattern  
Antenna: PSIFM-3-DA  
Type: 3-Bay Directional FM  
Gain H-pol (solid): 2.25 (3.52 dB)  
Gain V-pol (dash): 2.20 (3.42 dB)  
Frequency: 105.7 MHz  
Station: WTBK Manchester, KY

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***PO Box 113***  
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# Measured Relative Field Tabulation

Antenna: PSIFM-3-DA  
 Manchester Communications, Inc.  
 Station: WTBK  
 Frequency: 105.7 MHz  
 Location: Manchester, KY

## Horizontal Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.959	2.07	3.16
10	0.968	2.11	3.24
20	0.974	2.13	3.29
30	0.990	2.20	3.43
40	0.998	2.24	3.50
50	0.975	2.14	3.30
60	0.931	1.95	2.90
70	0.866	1.69	2.27
80	0.773	1.34	1.28
90	0.672	1.02	0.07
100	0.566	0.72	-1.42
110	0.496	0.55	-2.57
120	0.496	0.55	-2.56
130	0.534	0.64	-1.92
140	0.593	0.79	-1.01
150	0.618	0.86	-0.66
160	0.609	0.83	-0.79
170	0.558	0.70	-1.55
180	0.484	0.53	-2.77
190	0.433	0.42	-3.76
200	0.463	0.48	-3.17
210	0.568	0.73	-1.39
220	0.662	0.99	-0.06
230	0.715	1.15	0.61
240	0.798	1.43	1.56
250	0.840	1.59	2.01
260	0.861	1.67	2.22
270	0.863	1.68	2.24
280	0.832	1.56	1.92
290	0.801	1.44	1.59
300	0.800	1.44	1.58
310	0.837	1.58	1.98
320	0.878	1.73	2.39
330	0.908	1.86	2.69
340	0.947	2.02	3.04
350	0.958	2.06	3.14

### Maximum Value (H-pol)

Field 1.00  
 Gain 2.25 (3.52 dB)  
 Azimuth Bearing 38 degrees  
 Pattern RMS 0.78

### Minimum Field (H-pol)

Field 0.433  
 Gain .42 (-3.76 dB)  
 Azimuth Bearing 190 degrees

## Vertical Polarization

Angle	Relative Field	Power Gain	Gain (dB)
0	0.985	2.18	3.39
10	0.989	2.20	3.42
20	0.981	2.16	3.35
30	0.961	2.08	3.18
40	0.922	1.91	2.82
50	0.868	1.70	2.29
60	0.794	1.42	1.52
70	0.705	1.12	0.49
80	0.604	0.82	-0.87
90	0.494	0.55	-2.61
100	0.396	0.35	-4.52
110	0.328	0.24	-6.16
120	0.280	0.18	-7.54
130	0.262	0.15	-8.11
140	0.263	0.16	-8.08
150	0.284	0.18	-7.42
160	0.295	0.20	-7.09
170	0.282	0.18	-7.48
180	0.280	0.18	-7.54
190	0.298	0.20	-7.01
200	0.374	0.31	-5.03
210	0.432	0.42	-3.77
220	0.500	0.56	-2.51
230	0.616	0.85	-0.68
240	0.720	1.17	0.66
250	0.813	1.49	1.73
260	0.888	1.77	2.49
270	0.942	2.00	3.00
280	0.974	2.14	3.30
290	0.988	2.19	3.41
300	0.988	2.20	3.41
310	0.980	2.16	3.34
320	0.971	2.12	3.26
330	0.967	2.10	3.23
340	0.969	2.11	3.25
350	0.977	2.15	3.32

### Maximum Value (V-pol)

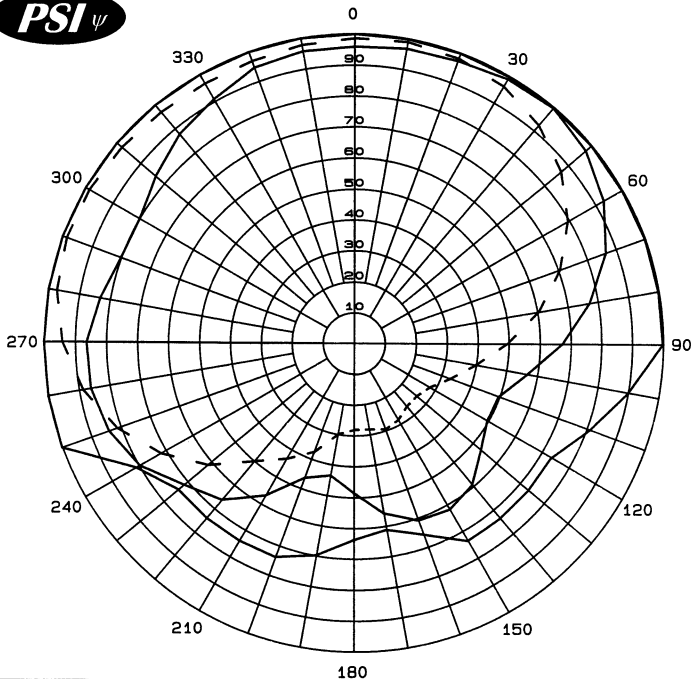
Field 0.99  
 Gain 2.20 (3.42 dB)  
 Azimuth Bearing 10 degrees  
 Pattern RMS 0.75

### Minimum Field (V-pol)

Field 0.262  
 Gain .15 (-8.11 dB)  
 Azimuth Bearing 130 degrees



**PSI**  $\psi$



Measured Relative Field and  
Maximum Envelope Comparison  
Antenna: PSIFM-3-DA  
Type: 3-Bay Directional FM  
Gain H-pol (solid): 2.25 (3.52 dB)  
Gain V-pol (dash): 2.20 (3.42 dB)  
Frequency: 105.7 MHz  
Station: WTBK Manchester, KY

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## ERP Tabulation

Antenna: PSIFM-3-DA

Manchester Communications, Inc.

Station: WTBK

Frequency: 105.7 MHz

Location: Manchester, KY

Maximum ERP: 5 kW ( 6.99 dBk)

### Horizontal Polarization

Angle	Relative Field	ERP kW	ERP dBK
0	0.959	4.60	6.63
10	0.968	4.69	6.71
20	0.974	4.74	6.76
30	0.990	4.90	6.90
40	0.998	4.98	6.97
50	0.975	4.75	6.77
60	0.931	4.33	6.37
70	0.866	3.75	5.74
80	0.773	2.99	4.75
90	0.672	2.26	3.54
100	0.566	1.60	2.05
110	0.496	1.23	0.90
120	0.496	1.23	0.91
130	0.534	1.43	1.55
140	0.593	1.76	2.45
150	0.618	1.91	2.80
160	0.609	1.85	2.68
170	0.558	1.55	1.92
180	0.484	1.17	0.69
190	0.433	0.94	-0.29
200	0.463	1.07	0.29
210	0.568	1.61	2.08
220	0.662	2.19	3.41
230	0.715	2.56	4.08
240	0.798	3.18	5.03
250	0.840	3.53	5.47
260	0.861	3.71	5.69
270	0.863	3.72	5.71
280	0.832	3.46	5.39
290	0.801	3.21	5.06
300	0.800	3.20	5.05
310	0.837	3.50	5.44
320	0.878	3.85	5.86
330	0.908	4.12	6.15
340	0.947	4.48	6.51
350	0.958	4.58	6.61

#### Maximum Value (H-pol)

Field 1.00  
ERP 5 kW (6.99 dBk)  
Azimuth Bearing 38 degrees

#### Minimum Field (H-pol)

Field 0.433  
ERP .94 kW (-29 dBk)  
Azimuth Bearing 190 degrees

### Vertical Polarization

Angle	Relative Field	ERP kW	ERP dBk
0	0.985	4.85	6.86
10	0.989	4.89	6.89
20	0.981	4.81	6.82
30	0.961	4.62	6.65
40	0.922	4.25	6.29
50	0.868	3.77	5.76
60	0.794	3.15	4.99
70	0.705	2.49	3.96
80	0.604	1.82	2.60
90	0.494	1.22	0.86
100	0.396	0.79	-1.05
110	0.328	0.54	-2.69
120	0.280	0.39	-4.07
130	0.262	0.34	-4.64
140	0.263	0.35	-4.61
150	0.284	0.40	-3.95
160	0.295	0.43	-3.63
170	0.282	0.40	-4.01
180	0.280	0.39	-4.07
190	0.298	0.44	-3.54
200	0.374	0.70	-1.56
210	0.432	0.93	-0.30
220	0.500	1.25	0.96
230	0.616	1.90	2.79
240	0.720	2.59	4.13
250	0.813	3.31	5.19
260	0.888	3.94	5.96
270	0.942	4.44	6.47
280	0.974	4.75	6.77
290	0.988	4.88	6.88
300	0.988	4.88	6.88
310	0.980	4.80	6.81
320	0.971	4.71	6.73
330	0.967	4.68	6.70
340	0.969	4.69	6.71
350	0.977	4.78	6.79

#### Maximum Value (V-pol)

Field 0.99  
ERP 4.89 kW (6.89 dBk)  
Azimuth Bearing 10 degrees

#### Minimum Field (V-pol)

Field 0.262  
ERP .34 kW (-4.64 dBk)  
Azimuth Bearing 130 degrees

**Composite Pattern**  
**Maximum of H-pol or V-pol**

Antenna: PSIFM-3-DA  
Manchester Communications, Inc.  
Station: WTBK  
Frequency: 105.7 MHz  
Location: Manchester, KY  
Maximum ERP: 5 kW ( 6.99 dBk)

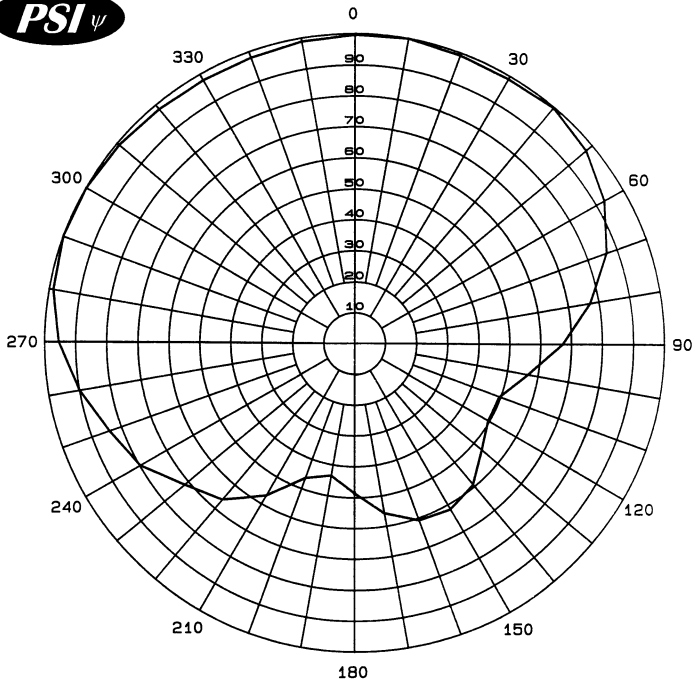
Angle	Relative Field	ERP kW	ERP dBK
0	0.985	4.85	6.86
10	0.989	4.89	6.89
20	0.981	4.81	6.82
30	0.990	4.90	6.90
40	0.998	4.98	6.97
50	0.975	4.75	6.77
60	0.931	4.33	6.37
70	0.866	3.75	5.74
80	0.773	2.99	4.75
90	0.672	2.26	3.54
100	0.566	1.60	2.05
110	0.496	1.23	0.90
120	0.496	1.23	0.91
130	0.534	1.43	1.55
140	0.593	1.76	2.45
150	0.618	1.91	2.80
160	0.609	1.85	2.68
170	0.558	1.55	1.92
180	0.484	1.17	0.69
190	0.433	0.94	-0.29
200	0.463	1.07	0.29
210	0.568	1.61	2.08
220	0.662	2.19	3.41
230	0.715	2.56	4.08
240	0.798	3.18	5.03
250	0.840	3.53	5.47
260	0.888	3.94	5.96
270	0.942	4.44	6.47
280	0.974	4.75	6.77
290	0.988	4.88	6.88
300	0.988	4.88	6.88
310	0.980	4.80	6.81
320	0.971	4.71	6.73
330	0.967	4.68	6.70
340	0.969	4.69	6.71
350	0.977	4.78	6.79

Maximum ERP

Field 1.00  
ERP 5.0 (6.99 dBk)  
Azimuth Bearing 38 degrees  
Pattern RMS 0.81

Minimum ERP

Field 0.433  
ERP .94 kW (-.29 dBk)  
Azimuth Bearing 190 degrees



Measured Composite Pattern  
Combined Polarization  
Antenna: PSIFM-3-DA  
Type: 3-Bay Directional FM  
Peak ERP: 5.0 kW (6.99 dBk)  
Frequency: 105.7 MHz  
Station: WTBK Manchester, KY

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1

.9

.8

.7

.6

.5

.4

.3

.2

.1

30

20

10

0

-10

-20

-30

-40

-50

-60

-70

-80

-90

RELATIVE FIELD

DEGREES BELOW HORIZONTAL



Relative Field Elevation Pattern

Model: PSIFM-3-DA

Type: 3-Bay FM Antenna

Polarization: Circular

Call Letters: WTBK

Gain: 2.25 (3.25 dB)