

# ETC Communications

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## Report of Test FM-1V-DA PLUS FM-1H-ND For Smile FM, WDTE 88.3 MHz Grosse Pointe Shores, MI

### **OBJECTIVE:**

The objective of this test was to demonstrate the directional characteristics of a FM-1V-DA PLUS FM-1H-ND to meet the needs of WDTE and to comply with the requirements of the FCC construction permit, file number BNPED-20071019AFB.

### **RESULTS:**

The measured vertical azimuth pattern for the FM-1V-DA PLUS FM-1H-ND is shown in Figure 2. The horizontal azimuth pattern of this antenna is non-directional and therefore is not shown. Figure 1 shows the Tabulation of the Vertical Polarization. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BNPED-20071019AFB indicates that the Vertical radiation component shall not exceed 5.5 kW at any azimuth.

From Figure 1, the maximum radiation of the Vertical component occurs at 170 Degrees T. At the restricted azimuth of 270 Degrees T the Vertical component is at least 15 dB down from the maximum of 5.5 kW, or 0.16 kW.

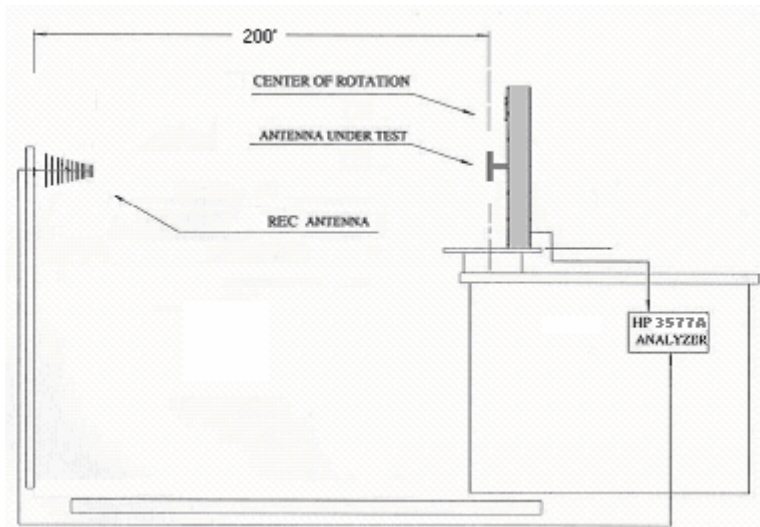
The R.M.S. of the Vertical component is 0.52504526. The total Vertical power gain is 3.627. See Figure 4 for calculations. The R.M.S. of the modified FCC theoretical pattern is 0.62086709. Therefore this Pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

**METHOD OF DIRECTIONALIZATION:**

One bay of the FM-1V-DA PLUS FM-1H-ND dipole-type antenna was mounted on a 2-3/8" pipe of exact size to the Pipe mounted atop the monopole tower present at site. The spacing and mounting angle of the antenna and directors / reflector in relation to the pipe was varied to achieve the azimuth pattern shown in Figure 2. See Figure 5 for mechanical details. (The horizontal antenna orientation is not specified since it is non-directional, but it should be mounted at least 60" below or above vertical bay.)

**METHOD OF MEASUREMENT:**

As allowed by the construction permit, file number BNPED-20071019AFB, a single level of the FM-1V-DA PLUS FM-1H-ND was set up on a rural "quiet zone" 80-acre antenna pattern measuring range, a scale of 1:1 was used.



**EQUIPMENT:**

The full-scale model pattern range consists of a rotating device equipped with an electronic position indicator. The full-scale tower section is placed on the top of rotating device and is used in the transmission mode at approximately 20 feet above ground level. A small diameter wooden support structure holds a broadband FM receiving yagi antenna that is spaced 200 feet away from the rotating device at the same level above ground as the transmitting antenna. The transmitting and receiving signals are carried to a control area by means of RG-8 type and RG-6 type double-shielded coax cables, respectively. The control area is equipped with: Hewlett Packard Model 3577A Network Analyzer. The test equipment is calibrated to ANSI/NCSL Z540-1-1994.

**TEST PROCEDURES:**

The network analyzer was set to the frequency of 88.3 MHz. Calibrated physical markers are used to check the linearity of the measuring system. From the recorded patterns, the R.M.S. values are calculated and recorded as shown in Figure 4.

Respectfully submitted by:

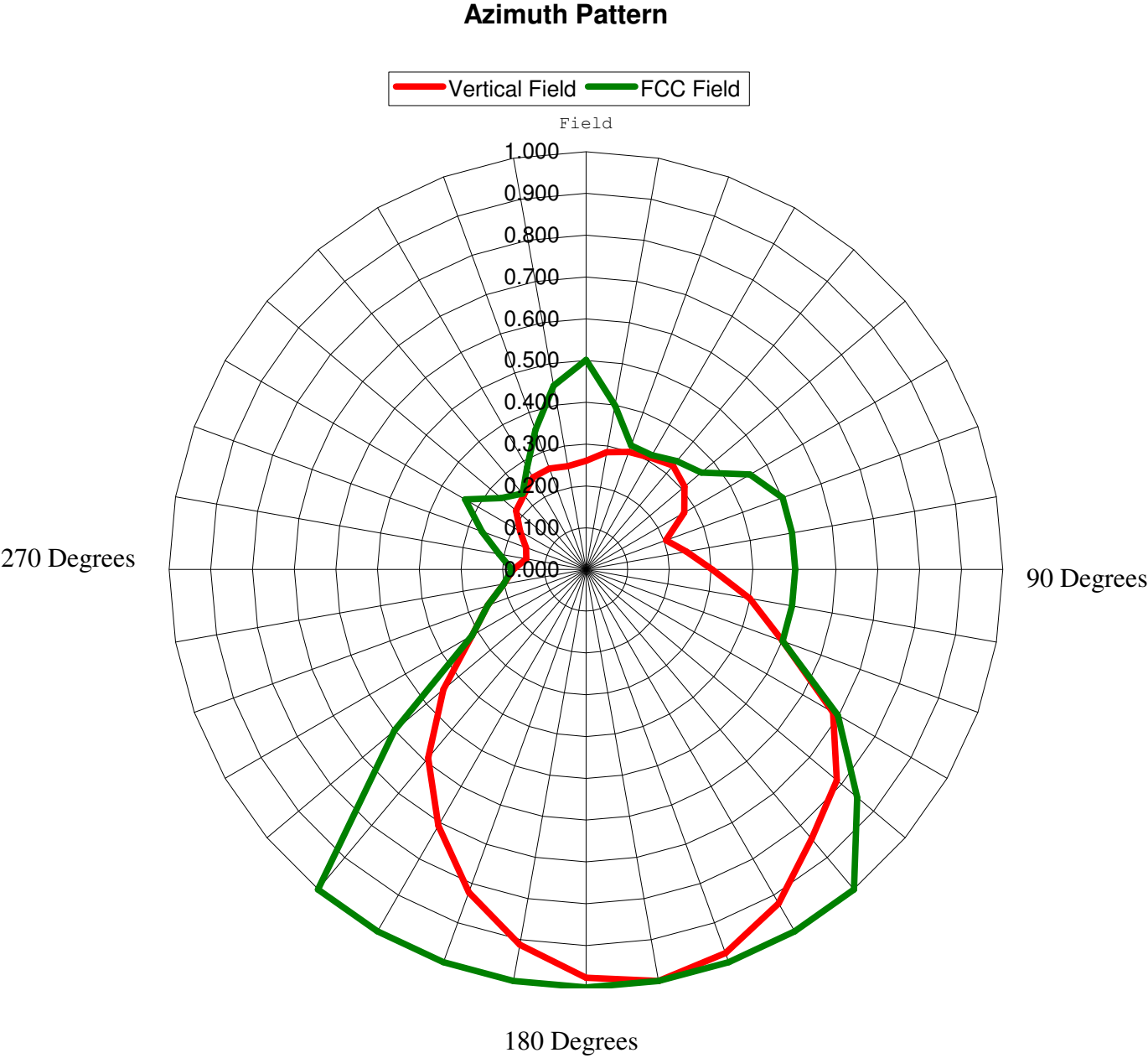
*Ed Czelada*

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May 25, 2012

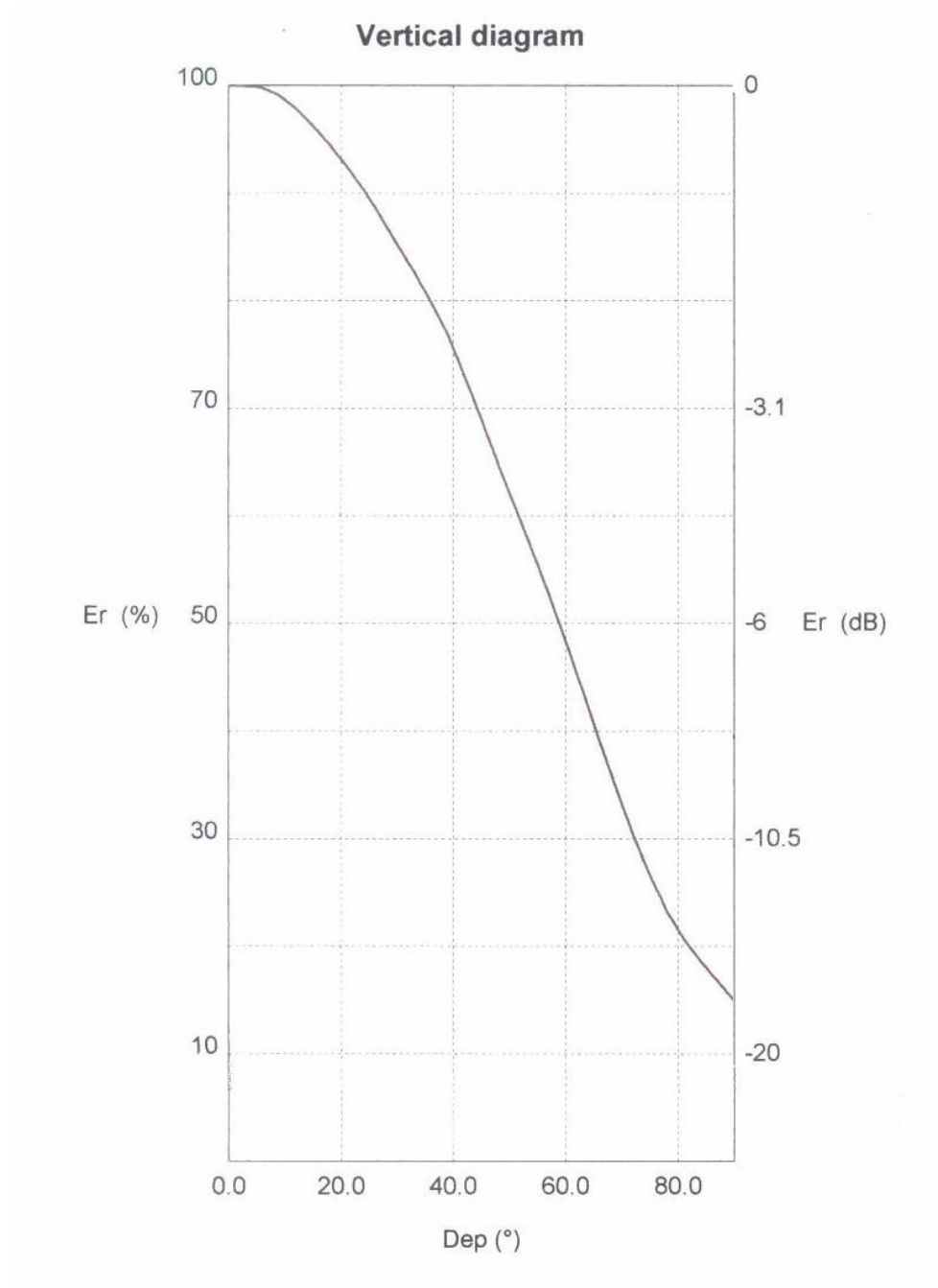
**Figure 1**  
**TABULATION OF VERTICAL POLARIZATION**  
**WDTE GROSSE POINT SHORES, MI**  
**MODEL FM-1V-DA PLUS FM-1H-ND**

Degrees	Vertical Field	FCC Field
0	0.260	0.501
10	0.285	0.398
20	0.299	0.316
30	0.309	0.316
40	0.324	0.338
50	0.309	0.361
60	0.272	0.454
70	0.204	0.501
80	0.245	0.501
90	0.302	0.501
100	0.398	0.501
110	0.501	0.501
120	0.684	0.698
130	0.785	0.849
140	0.841	1.000
150	0.923	1.000
160	0.977	1.000
170	1.000	1.000
180	0.977	1.000
190	0.912	1.000
200	0.822	1.000
210	0.708	1.000
220	0.589	1.000
230	0.447	0.600
240	0.316	0.316
250	0.251	0.251
260	0.200	0.200
270	0.174	0.178
280	0.145	0.211
290	0.153	0.266
300	0.182	0.335
310	0.219	0.266
320	0.232	0.237
330	0.254	0.282
340	0.257	0.355
350	0.251	0.447
265*	0.182	0.184
315*	0.226	0.237

Figure 2  
POLAR PLOT OF VERTICAL POLARIZATION  
WDTE GROSSE POINT SHORES, MI  
MODEL FM-1V-DA PLUS FM-1H-ND



**FIGURE 3**  
**Vertical Pattern**  
**WDTE GROSSE POINT SHORES, MI**  
**MODEL FM-1V-DA PLUS FM-1H-ND**



**FIGURE 4**  
**VALIDATION OF GAIN CALCULATION**  
**WDTE GROSSE POINT SHORES, MI**  
**MODEL FM-1V-DA PLUS FM-1H-ND**

Elevation Gain of FM-1V-DA PLUS FM-1H-ND equals  
Vertical 1.00

Vertical Azimuth Gain equals  $1/(\text{RMS})^2$   
 $1/(0.52504526)^2 = 3.627$

**\* Total Horizontal Gain is 1.00**

**\* Total Vertical Gain is Elevation Gain times Azimuth Gain**  
**1.00 x 3.627 = 3.627**

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ERP divided by Vertical Gain equals Antenna Input Power to  
Vertical Antenna  $5.50 \text{ kW} \div 3.627 = 1.516 \text{ kW}$

ERP divided by Horizontal Gain equals Antenna Input Power  
to Horizontal Antenna  $0.160 \text{ kW} \div 1.000 = 0.160 \text{ kW}$

Total Antenna Input Power through custom power divider  
 $1.516 \text{ kW} + 0.160 \text{ kW} = 1.676 \text{ kW}$

**FIGURE 5**  
**Antenna Mounting and Orientation (vertical antenna)**  
**WDTE GROSSE POINT SHORES, MI**  
**MODEL FM-1V-DA PLUS FM-1H-ND**

