ETC Communications

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Report of Test FM-1V-DA Special (slant)
For
Penn-Jersey Educ Radio CO., WPNJ 90.5 MHz Easton, PA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a FM-1V-DA to meet the needs of WPNJ and to comply with the requirements of the FCC construction permit, file number BMPED-20121025AAC.

RESULTS:

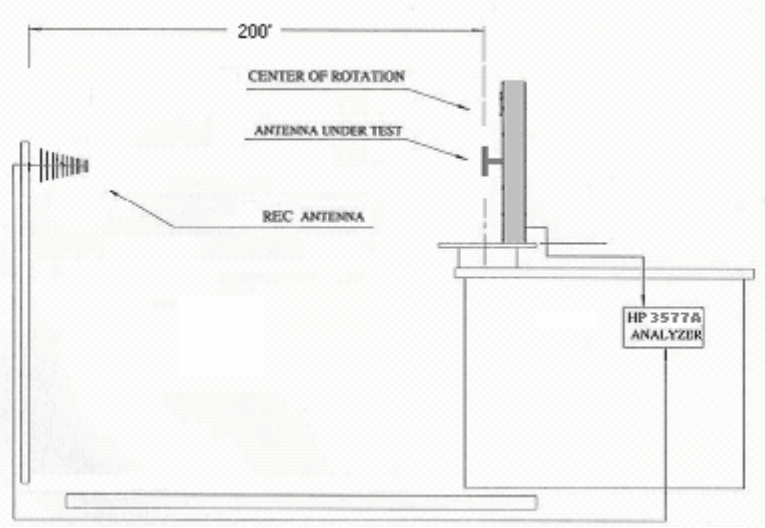
The measured azimuth pattern for the FM-1V-DA Special (slant) is shown in Figure 2. Figure 1 shows the Tabulation of the Vertical Polarization. The horizontal component of this antenna was developed by constructing the dipole 0.25° off of vertical. The horizontal azimuth pattern of this antenna is omni-directional and therefore is not shown. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BMPED-20121025AAC indicates that the Vertical radiation component shall not exceed 0.75 kW at any azimuth.

From Figure 1, the maximum radiation of the Vertical component occurs between 330 Degrees T. At the first restricted azimuth of 60 Degrees T the Vertical component is at least 3.61 dB down from the maximum of 0.75 kW, or 0.327 kW. At the second restricted azimuth of 130 Degrees T the Vertical component is at least 7.85 dB down from the maximum of 0.75 kW, or 0.123 kW. At the third restricted azimuth of 130 Degrees T the Vertical component is at least 12.73 dB down from the maximum of 0.75 kW, or 0.040 kW.

The R.M.S. of the Vertical component is 0.5977728. The total Vertical power gain is 2.7425. See Figure 4 for calculations. The R.M.S. of the FCC theoretical pattern is 0.7020707. 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 dipole-type antenna was mounted on a pipe of exact scale to the one present at site. The spacing and mounting angle of the antenna and directors in relation to the pipe was varied to achieve the azimuth pattern shown in Figure 2. See Figure 5 for mechanical details.

METHOD OF MEASUREMENT:
As allowed by the construction permit, file number BMPED-20121025AAC, a single level of the FM-1V-DA 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 pipe 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 90.5 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:
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Figure 1
TABULATION OF VERTICAL POLARIZATION
WPNJ EASTON, PA
MODEL FM-1V-DA Special (slant)

Degrees	Vertical Field	FCC Field
0	0.81	0.9
10	0.688	0.92
20	0.612	0.92
30	0.56	1.000
40	0.54	1.000
50	0.61	0.9
60	0.652	0.66
70	0.684	0.794
80	0.646	0.841
90	0.519	0.841
100	0.422	0.663
110	0.355	0.528
120	0.367	0.42
130	0.394	0.405
140	0.394	0.41
150	0.339	0.37
160	0.204	0.28
170	0.122	0.23
180	0.162	0.29
190	0.228	0.4
200	0.363	0.49
210	0.398	0.52
220	0.412	0.52
230	0.432	0.437
240	0.427	0.427
250	0.417	0.417
260	0.484	0.484
270	0.55	0.55
280	0.668	0.668
290	0.767	0.767
300	0.822	0.822
310	0.902	0.902
320	0.977	0.98
330	1.000	1.000
340	0.977	0.98
350	0.912	0.95

Figure 2
POLAR PLOT OF VERTICAL POLARIZATION
WPNJ EASTON, PA
MODEL FM-1V-DA Special (slant)

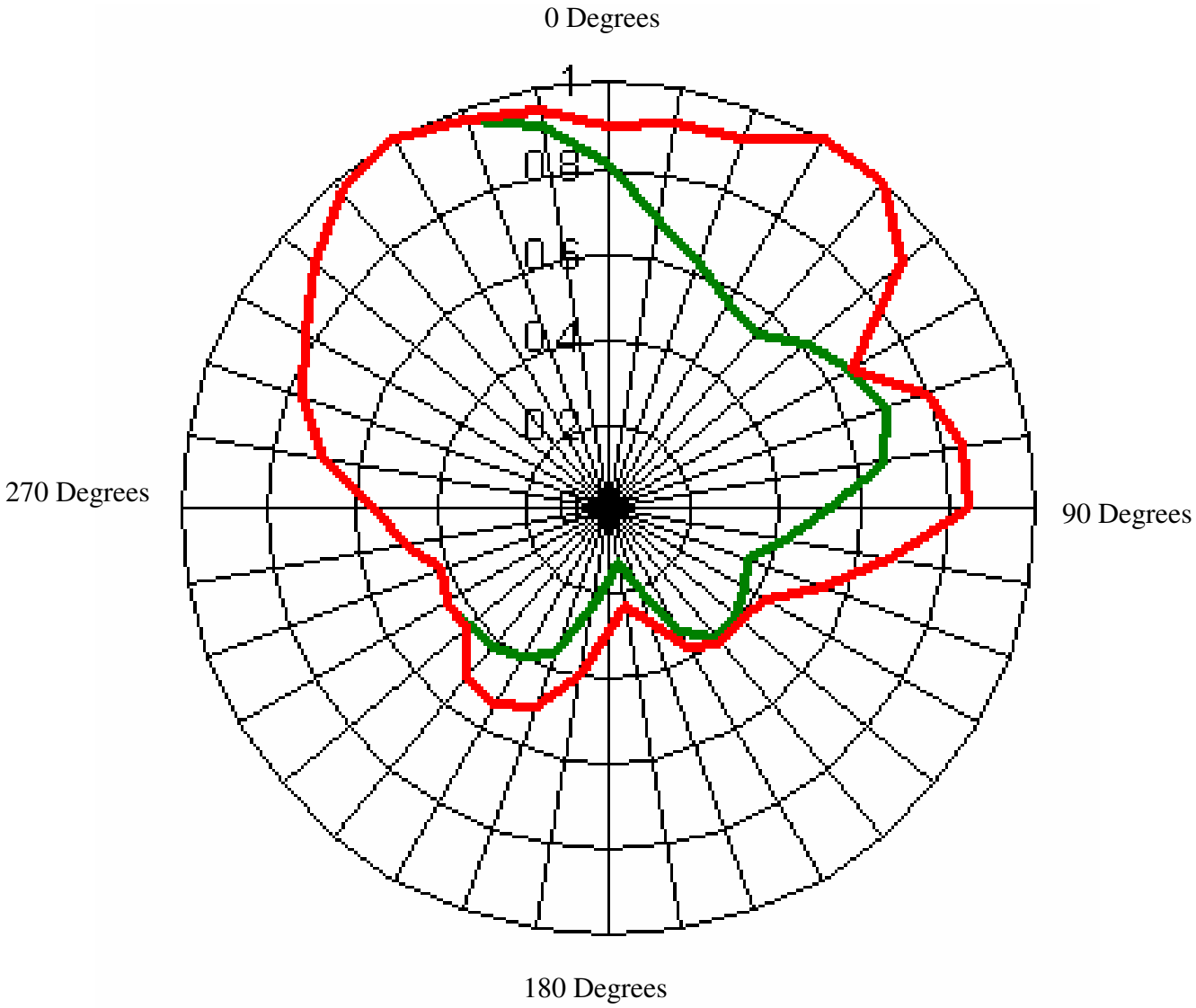

FIGURE 3
Vertical Pattern
WPNJ EASTON, PA
MODEL FM-1V-DA Special (slant)

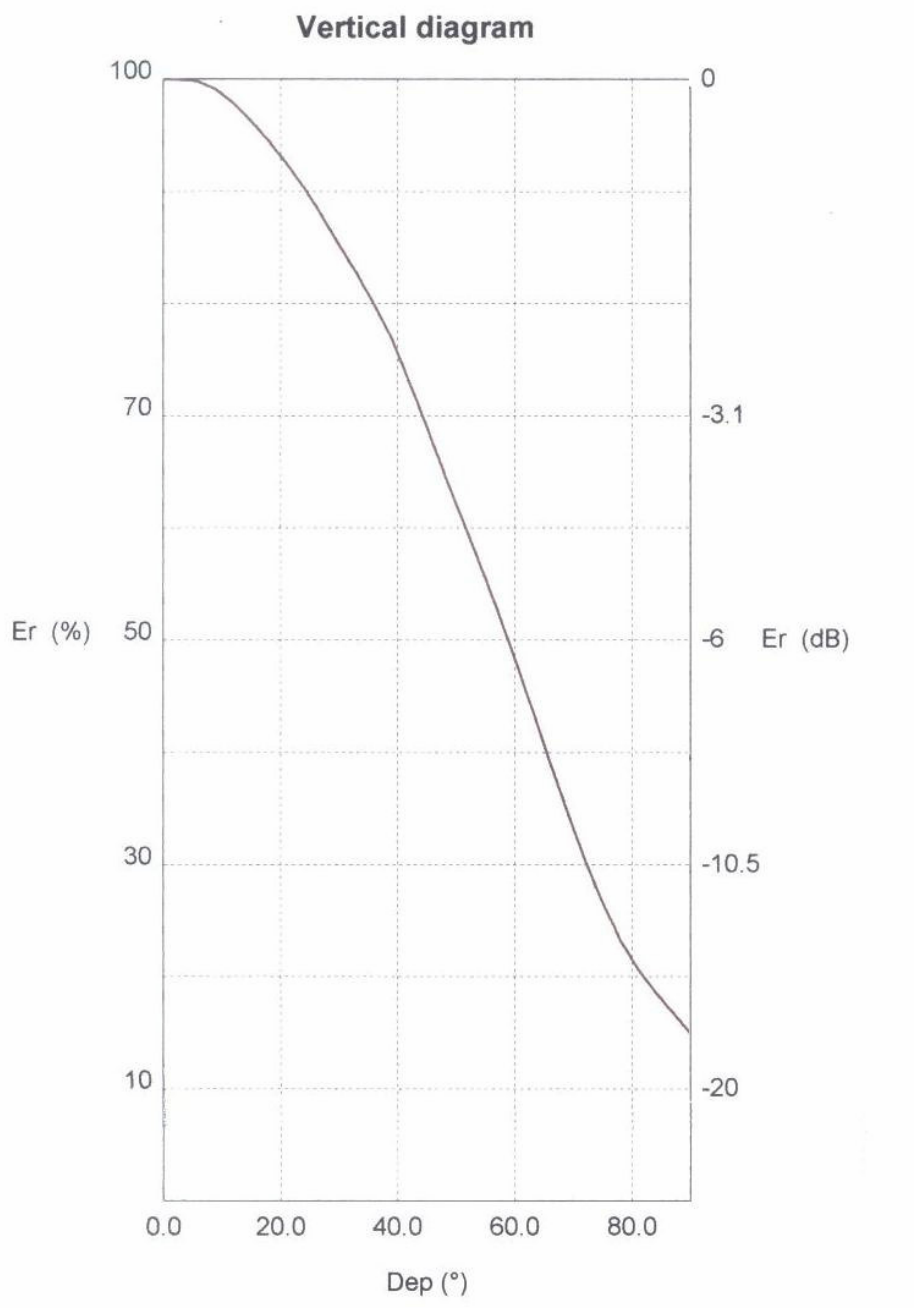

FIGURE 4
VALIDATION OF GAIN CALCULATION
WPNJ EASTON, PA
MODEL FM-1V-DA Special (slant)

Elevation Gain of FM-1V-DA equals
Vertical 0.98

Vertical Azimuth Gain equals $1/(RMS)^2$
$1/(0.5977728)^2 = 2.798515$

* Total Vertical Gain is Elevation Gain times Azimuth Gain
.98 x 2.798515 = 2.742545

ERP divided by Vertical Gain equals Antenna Input Power
0.75 kW ÷ 2.742545 = 0.27346 kW

FIGURE 5
Antenna Mounting and Orientation
WPNJ EASTON, PA
MODEL FM-1V-DA Special (slant)