2 on the Form 301 application),. Their locations are shown on the map in Figure 2. The reference point for WTVE remains at the location established in the Appendix B DTV Table of Allotments,[3] at a site known as Fancy Hill North (at coordinates 40-19-52 N, 75-41-41 W), also shown in Figure 2.

The Roxborough site was used for the most powerful transmitter in the DTS network in order to collocate it with an adjacent channel station in the same market, thereby overcoming, to the greatest extent possible, the interference from that adjacent channel neighbor to the service from WTVE. Collocation was required to avoid the loss of about 50 percent of the potential audience of the station to adjacent-channel interference that otherwise would have occurred. Roxborough is the site for which a license to cover recently has been granted for the facilities authorized in the most recent construction permit held by the station.

The Site 1 transmitter location at Reading, on Mt Penn, is the site from which the station has operated throughout its history, starting on Channel 51 with its analog facilities. It does now and will continue to provide service to the principal community of Reading, PA. Until it was just replaced by the newly-licensed facility at Roxborough, WTVE had a licensed, full-service but low-power, DTV facility at the Reading site (in File No. BLCDT-20040323ATZ). That original facility was supplanted by the DTS transmitter placed at the site under the Interim DTS Policy STA.

Facilities

The facilities requested in this application include continued operation at 763 W ERP at 225.4 meters HAAT at Site 1 in Reading and continued operation at 126 kW ERP at a height above average terrain (HAAT) of 378.4 meters at Site 2 in the Roxborough antenna farm. Both sites meet the requirements for maximum allowable facilities specified by §73.622(f)(8)(ii) of the Commission's Rules, as further permitted for DTS operations by the DTS R&O.[4] The basic characteristics of the transmitters proposed for authorization herein are given in Figures 1a and 1b for Sites 1 and 2, respectively, at the

[3] Memorandum Opinion and Order on Reconsideration of the Seventh Report and Order and the Eighth Report and Order *In the Matter of Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service*, MB Docket No. 87-268 (FCC 08-72, released March 6, 2008).
[4] DTS R&O ¶41.

end of this Technical Statement and in the related DTS Engineering portions of the Form 301 application – one for each transmitter.

Two fundamental antenna designs are included in the WTVE DTS network. The Site 1 antenna at Reading is a corporate-fed, cavity-slot design with parasitic radiators. It has a medium cardioid-shaped pattern intended to maximize the service in the Reading region to the north and west of Mt Penn. Because of the need to protect an in-market, adjacent-channel station, an unusual elevation pattern was used for the Reading antenna. It comprises a very narrow main beam near the horizontal (with a small amount of electrical beam tilt) and a pattern below the main beam shaped to result in nearly uniform field strength at locations from those in the peak of the beam to those near the base of the tower, assuming level terrain. The shape of the beam, relative to depression angle, follows that of the cosecant, turned upside down, with respect to relative field, and of the cosecant squared, turned upside down, with respect to power. Thus, the pattern can be described as an inverted cosecant (or cosecant-squared) shape. The shape used makes the field strength, in the region around a transmitter using it, a parameter of the network design, at least in areas where the terrain is level.

The Site 2 antenna at Roxborough is a four-sided, corporate-fed, panel array design with differing numbers of panels (8 and 12, respectively) on pairs of its faces. It has characteristics primarily intended to maximize service within the WTVE authorized service area plus DTS service circle, while constraining its contour to that limit to the extent possible, and originally also was intended to provide interference protection to analog co-channel stations in two adjacent markets and to a Class A station within its own market[5] by reducing field strength in their directions. The array pattern includes different electrical beam tilt values on different faces and notches above the main beams in the elevation patterns on two faces to aid in controlling both the contour location and interference to other stations. As a consequence, the pattern is quite complex and very difficult to describe in text and charts. A more complete description is included in the

[5] Protected stations included WNYE-TV, Channel 25, in New York City; WHAG-TV, Channel 25, in Hagerstown, MD; and W25AW, Channel 25, in Trenton, NJ. With respect to the latter, see the section below on Considerations Regarding Class A Stations.

data supplied with the Form 301 application in the Commission's CDBS Electronic Filing System, as described below.

Since it does not use an elevation pattern that varies with azimuth, the Reading antenna can be characterized by the combination of a single azimuth pattern and a single elevation pattern. Figure 3 contains a plot of the azimuth pattern used at Site 1. The tabulated relative field values used in the preparation of that pattern are given in Figure 4. The elevation pattern used at Reading is part of a family of patterns having the inverted cosecant squared shape and a set of electrical beam tilt angles that can be applied according to network design requirements. The family member used for the Reading DTS Site 1 transmitter has 0.7 degrees depression of the peak of the main beam and is plotted in Figures 5a and 5b, with two levels of detail. A portion of the tabulated data from which the Figure 5 plots were derived is given in Figure 6. (Complete pattern data are not included herein because of their size. But more complete elevation pattern data are included in the file uploaded to the CDBS Electronic Filing System [EFS], and full data are available upon request.) It should be noted that the azimuth pattern in Figures 3 and 4 are normalized to zero degrees and require rotation to the value given in Figure 1a and the Form 301 DTS for Site 1 (i.e., to 302 degrees).

Given its greater complexity, the Roxborough (Site 2) antenna requires more charts to document it. A plot of its relative field azimuthal radiation pattern at the depression angles having maximum radiation in each direction is provided as Figure 7a. Shown in Figure 7b is the relative field azimuthal radiation pattern at a depression angle of 0.8 degrees, which is the depression angle of the main beam from the 8-panel (southwest and northwest) faces. Plotted in Figure 7c is the relative field azimuthal radiation pattern at a depression angle of 3.4 degrees, which is the depression angle of the main beam from the 12-panel (northeast and southeast) faces. The tabulated azimuthal relative field values used in the derivation of Figures 7a, 7b, and 7c appear in Figure 8. The plots and data for the Roxborough antenna all are presented after necessary rotation of the antenna.

Because of the use of different electrical beam tilt values on the four faces, four elevation radiation patterns in relative field values are included as Figures 9a, 9b, 9c, and 9d for the

45-, 135-, 225, and 315-degree azimuths, respectively. The related tabulated elevation relative field values are given in Figure 10. While the elevation patterns are shown herein at bearings radiating directly out from the four faces of the antenna, the elevation patterns generated at azimuths between those bearings are quite complex. Consequently, in the file uploaded to the CDBS Electronic Filing System that characterizes the Roxborough antenna, data are provided for azimuths every 5 degrees around the compass, and even more detailed data (every degree of azimuth and every tenth of a degree of depression angle, throughout the array) can be supplied, if needed.

A plot of the PNLCs[6] of the transmitters is provided in Figure 2. Since the recently-licensed Roxborough transmitter facility (herein DTS Site 2) already covers the entire authorized service area of the station,[7] the provisions of §73.626(f)(1) are met by that facility alone. By virtue of the overlap of the contours of the two transmitters, they are contiguous, thereby meeting the requirements of §73.626(f)(3). Also shown in Figure 2 are the 48 dBu contours (in blue) of both the DTS Site 1 and DTS Site 2 facilities, both of which can be seen to encompass the principal community of Reading, PA. There is a major obstruction in the path over the principal community from Site 2 but not from Site 1; thus, the requirements of §73.626(f)(4) are met by the DTS Site 1 transmitter alone. These factors are discussed in more detail in the section below on Principal Community Coverage. Both transmitters in the proposed DTS network are located within the WTVE authorized service area, consequently meeting the requirements of §73.626(f)(6).

Given the complexity of the Site 2 antenna pattern, a large array of elevation data has been supplied for that antenna, using the complex data filing format specified for the Form 301 DTS application. It has been found in earlier filings for other stations that inclusion of azimuth pattern relative field or rotation data in the Form 301 DTS interferes with the correct determination of the amplitude characteristics and orientation of the pattern in the Commission's processing software. For this reason, the Site 2 Form 301

[6] To account for the dipole correction factor, the PNLCs are plotted at 39.85 dBu, with service statistics of F(50,90).

[7] Per §73.626(b), "For purposes of compliance with this section, a station's 'authorized service area' is defined as the area within its predicted noise-limited service contour determined using the facilities authorized for the station in a license or construction permit for non-DTS, single-transmitter-location operation."

DTS has been marked that the antenna is "Non-Directional." The antenna, however, is directional, with the alternate settings being required to make the Commission's input processing software correctly represent the data that describes the antenna. The actual azimuth rotation for the antenna at DTS Site 2 is provided in Figure 1b below and built into the complex elevation pattern data uploaded to the EFS.

Both of the transmitters used in the WTVE DTS network are Type Verified as per Section 73.1660 of the Commission's Rules. Both transmitters are of solid state designs. They are synchronized using the methods specified in the ATSC Synchronization Standard for Distributed Transmission (A/110B), and they emit the RF Watermark transmitter identification signal defined in the A/110B document.

Service Area

Section 73.622(f)(5) provides that stations may exceed the limits on power and antenna height included in §73.622(f)(6) through (8) "up to that needed to provide the same geographic coverage area as the largest station within their market." The DTS R&O applies the same exception to DTS operations. In ¶35 "Largest Station" Alternative, it states, "As an alternative to the Table of Distances Approach for determining the hypothetically maximized service area, full-power stations may use the 'largest station' provision in section 73.622(f)(5) of the rules."[8]

To implement the provisions of §73.622(f)(5), a method has been followed to determine the radius of a circle that matches the area contained within the contour of the largest station in the same market as that of the applicant. The market has been defined by the Commission as the DMA in which a station is located.[9] WTVE is located in the Philadelphia DMA. As noted in the First DTV Periodic Report and Order, "the geographical coverage determination is based on the area within the DTV station's noise-limited contour, calculated using predicted F(50,90) field strengths as set forth in section

[8] *Digital Television Distributed Transmission System Technologies*, Report and Order, MB Docket No. 05-312 (FCC 08-256, released November 7, 2008) ¶35.

[9] See *Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television*, MM Docket No. 00-39, Report and Order, 16 FCC Rcd 5946, 5973-4, ¶¶73-4 (2001) ("First DTV Periodic Report and Order").

Figure 1b — Technical Specifications — Proposed WTVE DTS Facility Channel 25 — Reading, PA — Site 2: Roxborough

Frequency

Channel	25
Frequency Band	536 – 542 MHz
Center Frequency	539 MHz

Location

Site	Roxborough Antenna Farm, Philadelphia, PA
Geographic Coordinates (NAD27)	40° 02’ 29.56” N 75° 14’ 12.89” W
Tower Registration (FAA Study Number)	1231524 (2008-AEA-3763-OE)

Elevation

Elevation of site above mean sea level	89.0 m
Overall height of tower above site elevation	383.1 m
Overall height of tower above mean sea level	472.1 m
Height of antenna radiation center above site elevation	354.6 m
Elevation of average terrain (45-degree-spaced radials, 3.2-16.1 km)	65.2 m
Height of antenna radiation center above mean sea level	443.6 m
Height of antenna radiation center above average terrain (HAAT)	378.4 m

Antenna

Manufacturer	Radio Frequency Systems
Model	PHP-40T
Description	Top-Mounted, Corporate-Fed, UHF Panel Array
Orientation (rotation around vertical axis)	225° true
Electrical beam tilt	Varies: 0.8 – 3.5°
Mechanical beam tilt	None
Polarization	Horizontal
Gain (peak of beam – 135° azimuth, 3.4° depression)	17.378 (12.40 dBd)
Gain (in horizontal plane – 221° azimuth, 0° depression)	14.588 (11.64 dBd)

Power

Effective radiated power (ERP) (peak of beam– 135 az., 3.4° depression)	126.0 kW
Effective radiated power (ERP) (maximum in horizontal plane)	105.8 kW

RFS PHP-40T

Peak Field at Any Depression Angle at Each Azimuth

Pattern Rotated to Actual Orientation

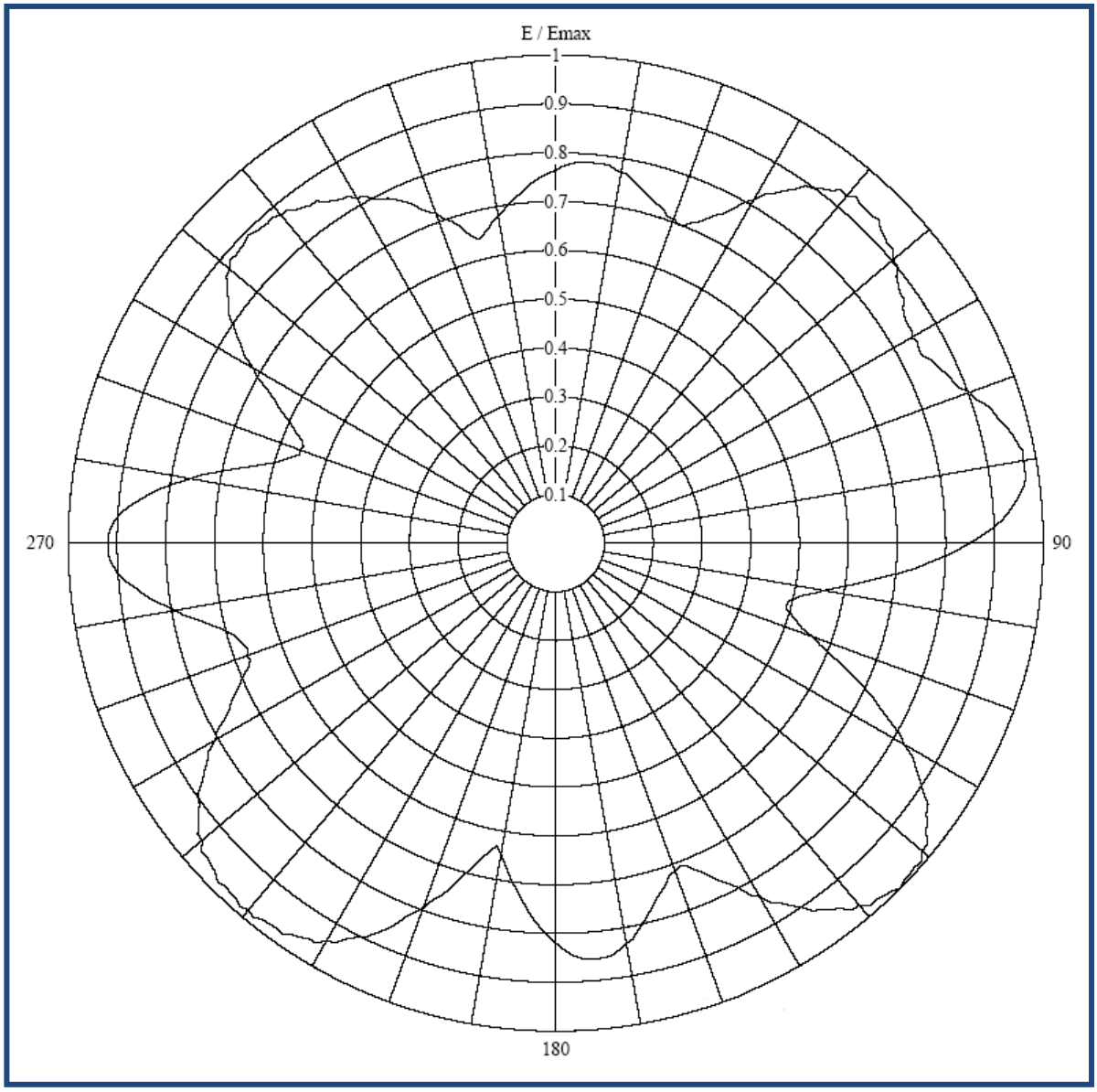

Figure 7a — Roxborough Azimuth Relative Field Pattern

RFS PHP-40T

Relative Field at 0.8 degrees Depression Angle

Pattern Rotated to Actual Orientation

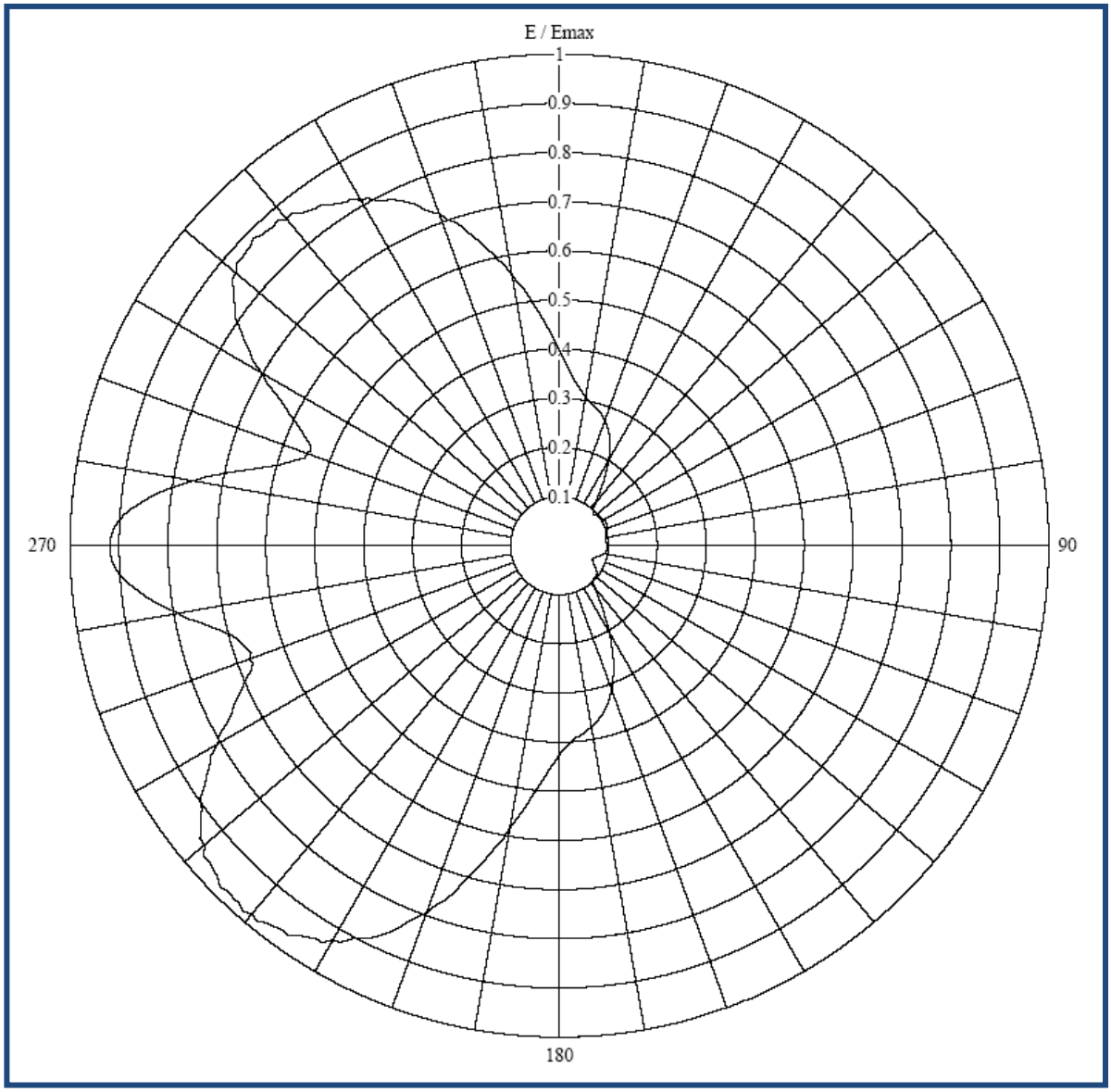

Figure 7b — Roxborough Azimuth Relative Field Pattern

RFS PHP-40T

Relative Field at 3.4 degrees Depression Angle

Pattern Rotated to Actual Orientation

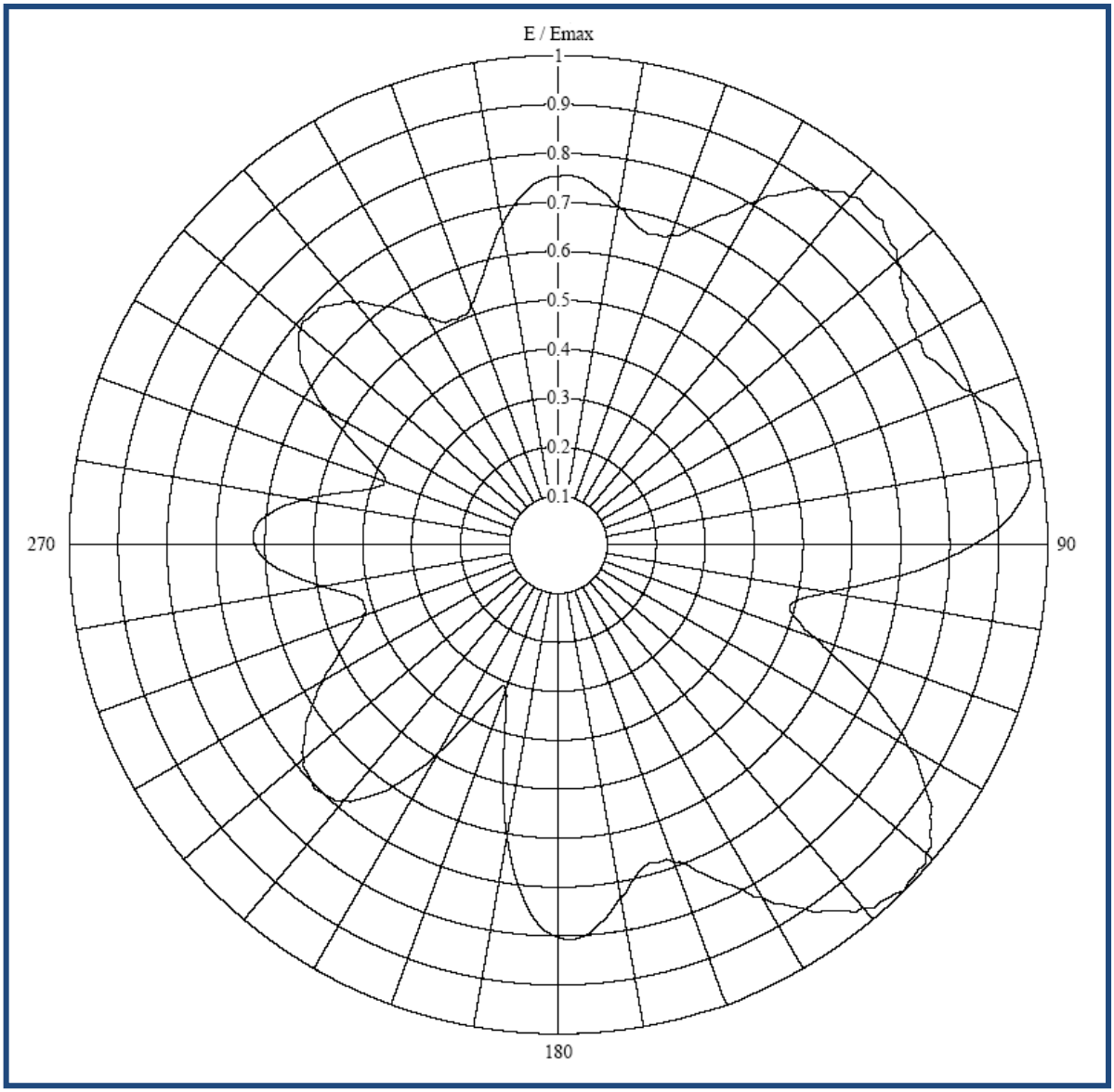

Figure 7c — Roxborough Azimuth Relative Field Pattern

Figure 8 — Tabulated Data for RFS PHP-40T Azimuth Relative Field Patterns – Roxborough

Azimuth	Peak	0.8 deg	3.4 deg	Azimuth	Peak	0.8 deg	3.4 deg	Azimuth	Peak	0.8 deg	3.4 deg	Azimuth	Peak	0.8 deg	3.4 deg
0	0.7638	0.3965	0.7532	45	0.9370	0.0977	0.9370	90	0.8486	0.0972	0.8479	135	1.0000	0.0990	1.0000
1	0.7718	0.3830	0.7558	46	0.9264	0.0956	0.9264	91	0.8241	0.0977	0.8234	136	0.9909	0.0995	0.9909
2	0.7770	0.3723	0.7552	47	0.9215	0.0949	0.9215	92	0.7963	0.0979	0.7958	137	0.9873	0.1017	0.9873
3	0.7809	0.3608	0.7525	48	0.9156	0.0948	0.9156	93	0.7667	0.0980	0.7663	138	0.9824	0.1043	0.9824
4	0.7835	0.3496	0.7496	49	0.9165	0.0957	0.9165	94	0.7397	0.0984	0.7396	139	0.9832	0.1084	0.9832
5	0.7835	0.3388	0.7433	50	0.9021	0.0957	0.9021	95	0.7076	0.0980	0.7076	140	0.9684	0.1130	0.9681
6	0.7827	0.3326	0.7340	51	0.9019	0.0977	0.9019	96	0.6713	0.0970	0.6713	141	0.9668	0.1195	0.9660
7	0.7833	0.3253	0.7284	52	0.8867	0.0977	0.8867	97	0.6418	0.0965	0.6418	142	0.9502	0.1252	0.9490
8	0.7817	0.3185	0.7211	53	0.8794	0.0991	0.8794	98	0.6132	0.0957	0.6132	143	0.9388	0.1336	0.9372
9	0.7754	0.3121	0.7099	54	0.8724	0.0999	0.8724	99	0.5842	0.0944	0.5842	144	0.9270	0.1414	0.9250
10	0.7713	0.3071	0.7014	55	0.8717	0.1019	0.8717	100	0.5580	0.0930	0.5580	145	0.9208	0.1514	0.9184
11	0.7698	0.3026	0.6969	56	0.8589	0.1019	0.8589	101	0.5395	0.0917	0.5393	146	0.8996	0.1604	0.8969
12	0.7596	0.2990	0.6846	57	0.8528	0.1027	0.8528	102	0.5168	0.0895	0.5163	147	0.8853	0.1698	0.8824
13	0.7526	0.2951	0.6772	58	0.8488	0.1036	0.8488	103	0.5032	0.0876	0.5024	148	0.8695	0.1808	0.8664
14	0.7444	0.2930	0.6695	59	0.8512	0.1049	0.8512	104	0.4924	0.0853	0.4915	149	0.8595	0.1925	0.8562
15	0.7362	0.2896	0.6645	60	0.8433	0.1048	0.8433	105	0.4900	0.0832	0.4889	150	0.8360	0.2034	0.8327
16	0.7279	0.2865	0.6612	61	0.8491	0.1062	0.8491	106	0.4931	0.0811	0.4921	151	0.8250	0.2151	0.8221
17	0.7238	0.2841	0.6643	62	0.8429	0.1056	0.8429	107	0.5063	0.0793	0.5055	152	0.8006	0.2254	0.7982
18	0.7169	0.2804	0.6656	63	0.8448	0.1057	0.8448	108	0.5204	0.0773	0.5198	153	0.7828	0.2371	0.7810
19	0.7066	0.2758	0.6638	64	0.8568	0.1067	0.8568	109	0.5332	0.0755	0.5328	154	0.7707	0.2496	0.7699
20	0.7074	0.2722	0.6749	65	0.8621	0.1066	0.8621	110	0.5602	0.0748	0.5601	155	0.7535	0.2608	0.7535
21	0.6994	0.2668	0.6762	66	0.8681	0.1063	0.8681	111	0.5793	0.0730	0.5793	156	0.7383	0.2716	0.7383
22	0.7018	0.2613	0.6866	67	0.8766	0.1061	0.8766	112	0.6056	0.0728	0.6056	157	0.7259	0.2823	0.7241
23	0.7127	0.2562	0.7043	68	0.8790	0.1049	0.8790	113	0.6389	0.0737	0.6389	158	0.7120	0.2920	0.7055
24	0.7206	0.2500	0.7170	69	0.8873	0.1040	0.8873	114	0.6678	0.0743	0.6678	159	0.7083	0.3019	0.6943
25	0.7330	0.2432	0.7319	70	0.9040	0.1041	0.9040	115	0.6961	0.0753	0.6961	160	0.7163	0.3120	0.6912
26	0.7477	0.2359	0.7477	71	0.9092	0.1027	0.9092	116	0.7249	0.0766	0.7249	161	0.7182	0.3204	0.6795
27	0.7579	0.2271	0.7579	72	0.9246	0.1023	0.9246	117	0.7484	0.0776	0.7484	162	0.7326	0.3295	0.6807
28	0.7758	0.2185	0.7751	73	0.9352	0.1014	0.9352	118	0.7751	0.0798	0.7751	163	0.7450	0.3375	0.6796
29	0.8000	0.2105	0.7985	74	0.9405	0.0999	0.9405	119	0.8070	0.0827	0.8070	164	0.7547	0.3438	0.6765
30	0.8113	0.2011	0.8093	75	0.9497	0.0990	0.9497	120	0.8253	0.0840	0.8253	165	0.7692	0.3505	0.6807
31	0.8354	0.1923	0.8330	76	0.9579	0.0981	0.9579	121	0.8556	0.0870	0.8556	166	0.7837	0.3566	0.6871
32	0.8450	0.1821	0.8423	77	0.9648	0.0972	0.9648	122	0.8705	0.0884	0.8705	167	0.7984	0.3609	0.6973
33	0.8606	0.1724	0.8578	78	0.9701	0.0966	0.9701	123	0.8910	0.0904	0.8910	168	0.8114	0.3663	0.7077
34	0.8745	0.1636	0.8718	79	0.9773	0.0964	0.9773	124	0.9083	0.0919	0.9083	169	0.8267	0.3705	0.7239
35	0.8940	0.1551	0.8914	80	0.9740	0.0954	0.9740	125	0.9320	0.0943	0.9320	170	0.8331	0.3746	0.7319
36	0.8987	0.1454	0.8963	81	0.9731	0.0949	0.9728	126	0.9397	0.0945	0.9397	171	0.8419	0.3784	0.7451
37	0.9088	0.1375	0.9065	82	0.9738	0.0953	0.9734	127	0.9527	0.0956	0.9527	172	0.8511	0.3825	0.7603
38	0.9171	0.1291	0.9151	83	0.9680	0.0953	0.9674	128	0.9645	0.0961	0.9645	173	0.8550	0.3863	0.7717
39	0.9303	0.1225	0.9287	84	0.9573	0.0951	0.9567	129	0.9802	0.0973	0.9802	174	0.8556	0.3901	0.7808
40	0.9287	0.1155	0.9273	85	0.9455	0.0952	0.9447	130	0.9811	0.0964	0.9811	175	0.8559	0.3916	0.7929
41	0.9392	0.1101	0.9383	86	0.9325	0.0959	0.9316	131	0.9942	0.0973	0.9942	176	0.8543	0.3978	0.8008
42	0.9338	0.1052	0.9331	87	0.9174	0.0965	0.9165	132	0.9912	0.0967	0.9912	177	0.8491	0.4041	0.8049
43	0.9337	0.1018	0.9334	88	0.8982	0.0969	0.8973	133	0.9932	0.0967	0.9932	178	0.8423	0.4103	0.8077
44	0.9322	0.0988	0.9321	89	0.8742	0.0971	0.8734	134	0.9938	0.0973	0.9938	179	0.8313	0.4159	0.8068

Figure 8 – cont'd.— Tabulated Data for RFS PHP-40T Azimuth Relative Field Patterns – Roxborough

Azimuth	Peak	0.8 deg	3.4 deg	Azimuth	Peak	0.8 deg	3.4 deg	Azimuth	Peak	0.8 deg	3.4 deg	Azimuth	Peak	0.8 deg	3.4 deg
180	0.8193	0.4248	0.8025	225	0.9815	0.9815	0.7060	270	0.9185	0.9174	0.6204	315	0.8930	0.8847	0.6879
181	0.8074	0.4370	0.7975	226	0.9710	0.9710	0.7002	271	0.9179	0.9169	0.6244	316	0.8862	0.8780	0.6781
182	0.7938	0.4483	0.7897	227	0.9665	0.9665	0.6966	272	0.9138	0.9129	0.6251	317	0.8848	0.8765	0.6707
183	0.7780	0.4616	0.7768	228	0.9614	0.9614	0.6922	273	0.9049	0.9040	0.6219	318	0.8824	0.8740	0.6630
184	0.7620	0.4764	0.7620	229	0.9624	0.9624	0.6916	274	0.8937	0.8929	0.6168	319	0.8857	0.8772	0.6601
185	0.7425	0.4924	0.7418	230	0.9470	0.9470	0.6789	275	0.8771	0.8764	0.6075	320	0.8756	0.8672	0.6448
186	0.7230	0.5074	0.7186	231	0.9451	0.9451	0.6751	276	0.8568	0.8561	0.5952	321	0.8770	0.8688	0.6398
187	0.7055	0.5278	0.6952	232	0.9282	0.9282	0.6608	277	0.8373	0.8367	0.5832	322	0.8668	0.8584	0.6235
188	0.6870	0.5472	0.6684	233	0.9162	0.9162	0.6494	278	0.8147	0.8140	0.5681	323	0.8609	0.8530	0.6118
189	0.6663	0.5629	0.6374	234	0.9040	0.9040	0.6388	279	0.7877	0.7870	0.5485	324	0.8556	0.8478	0.6014
190	0.6476	0.5837	0.6057	235	0.8968	0.8968	0.6303	280	0.7609	0.7600	0.5294	325	0.8556	0.8481	0.5934
191	0.6314	0.6098	0.5744	236	0.8750	0.8750	0.6129	281	0.7366	0.7355	0.5114	326	0.8433	0.8363	0.5773
192	0.6426	0.6264	0.5378	237	0.8598	0.8598	0.5996	282	0.7046	0.7034	0.4879	327	0.8370	0.8304	0.5658
193	0.6599	0.6481	0.5024	238	0.8427	0.8427	0.5846	283	0.6763	0.6748	0.4665	328	0.8301	0.8242	0.5543
194	0.6779	0.6699	0.4655	239	0.8315	0.8315	0.5741	284	0.6470	0.6452	0.4446	329	0.8288	0.8233	0.5474
195	0.6960	0.6911	0.4313	240	0.8064	0.8064	0.5543	285	0.6219	0.6194	0.4252	330	0.8155	0.8106	0.5331
196	0.7145	0.7121	0.3990	241	0.7948	0.7948	0.5431	286	0.5996	0.5962	0.4078	331	0.8132	0.8091	0.5289
197	0.7392	0.7383	0.3713	242	0.7699	0.7699	0.5239	287	0.5842	0.5798	0.3958	332	0.7991	0.7958	0.5166
198	0.7585	0.7585	0.3467	243	0.7514	0.7514	0.5081	288	0.5704	0.5644	0.3857	333	0.7901	0.7877	0.5092
199	0.7717	0.7717	0.3253	244	0.7404	0.7404	0.4964	289	0.5571	0.5498	0.3768	334	0.7861	0.7842	0.5100
200	0.7966	0.7962	0.3158	245	0.7240	0.7240	0.4818	290	0.5583	0.5491	0.3789	335	0.7762	0.7750	0.5074
201	0.8099	0.8083	0.3072	246	0.7091	0.7091	0.4677	291	0.5544	0.5434	0.3787	336	0.7660	0.7654	0.5057
202	0.8274	0.8247	0.3116	247	0.6966	0.6966	0.4547	292	0.5616	0.5492	0.3880	337	0.7544	0.7544	0.5078
203	0.8511	0.8466	0.3256	248	0.6799	0.6799	0.4393	293	0.5783	0.5644	0.4046	338	0.7382	0.7382	0.5068
204	0.8679	0.8616	0.3408	249	0.6714	0.6713	0.4293	294	0.5929	0.5780	0.4198	339	0.7267	0.7267	0.5107
205	0.8840	0.8758	0.3614	250	0.6735	0.6734	0.4246	295	0.6110	0.5953	0.4387	340	0.7192	0.7192	0.5223
206	0.8992	0.8891	0.3856	251	0.6670	0.6668	0.4157	296	0.6313	0.6153	0.4596	341	0.7018	0.7013	0.5285
207	0.9069	0.8951	0.4089	252	0.6743	0.6740	0.4158	297	0.6481	0.6321	0.4782	342	0.6937	0.6925	0.5420
208	0.9191	0.9060	0.4363	253	0.6803	0.6799	0.4158	298	0.6710	0.6553	0.5007	343	0.6803	0.6782	0.5549
209	0.9363	0.9226	0.4684	254	0.6858	0.6852	0.4160	299	0.6991	0.6841	0.5282	344	0.6615	0.6584	0.5665
210	0.9404	0.9261	0.4911	255	0.6984	0.6977	0.4220	300	0.7163	0.7017	0.5458	345	0.6478	0.6429	0.5817
211	0.9559	0.9415	0.5224	256	0.7138	0.7129	0.4307	301	0.7448	0.7309	0.5721	346	0.6424	0.6267	0.5975
212	0.9560	0.9422	0.5434	257	0.7333	0.7323	0.4436	302	0.7599	0.7469	0.5875	347	0.6513	0.6100	0.6150
213	0.9623	0.9493	0.5680	258	0.7523	0.7512	0.4574	303	0.7802	0.7679	0.6068	348	0.6609	0.5931	0.6317
214	0.9676	0.9559	0.5895	259	0.7765	0.7754	0.4754	304	0.7977	0.7860	0.6237	349	0.6727	0.5803	0.6502
215	0.9778	0.9678	0.6149	260	0.7928	0.7916	0.4891	305	0.8204	0.8095	0.6439	350	0.6797	0.5587	0.6634
216	0.9745	0.9660	0.6285	261	0.8132	0.8119	0.5066	306	0.8297	0.8192	0.6522	351	0.6894	0.5414	0.6784
217	0.9766	0.9700	0.6446	262	0.8352	0.8338	0.5244	307	0.8424	0.8326	0.6637	352	0.7006	0.5279	0.6935
218	0.9786	0.9733	0.6593	263	0.8529	0.8515	0.5410	308	0.8550	0.8454	0.6726	353	0.7094	0.5104	0.7059
219	0.9860	0.9826	0.6762	264	0.8681	0.8667	0.5567	309	0.8697	0.8606	0.6849	354	0.7182	0.4910	0.7168
220	0.9805	0.9779	0.6814	265	0.8862	0.8848	0.5739	310	0.8719	0.8629	0.6852	355	0.7280	0.4760	0.7280
221	0.9876	0.9860	0.6947	266	0.9000	0.8987	0.5882	311	0.8845	0.8757	0.6937	356	0.7380	0.4589	0.7380
222	0.9799	0.9789	0.6955	267	0.9087	0.9074	0.5991	312	0.8822	0.8738	0.6897	357	0.7458	0.4425	0.7446
223	0.9791	0.9785	0.6990	268	0.9161	0.9148	0.6090	313	0.8849	0.8766	0.6890	358	0.7531	0.4268	0.7500
224	0.9768	0.9766	0.7013	269	0.9193	0.9181	0.6160	314	0.8863	0.8781	0.6868	359	0.7592	0.4121	0.7524

RFS PHP-40T

Relative Field at 45 degrees Azimuth Heading

Pattern Rotated to Actual Orientation

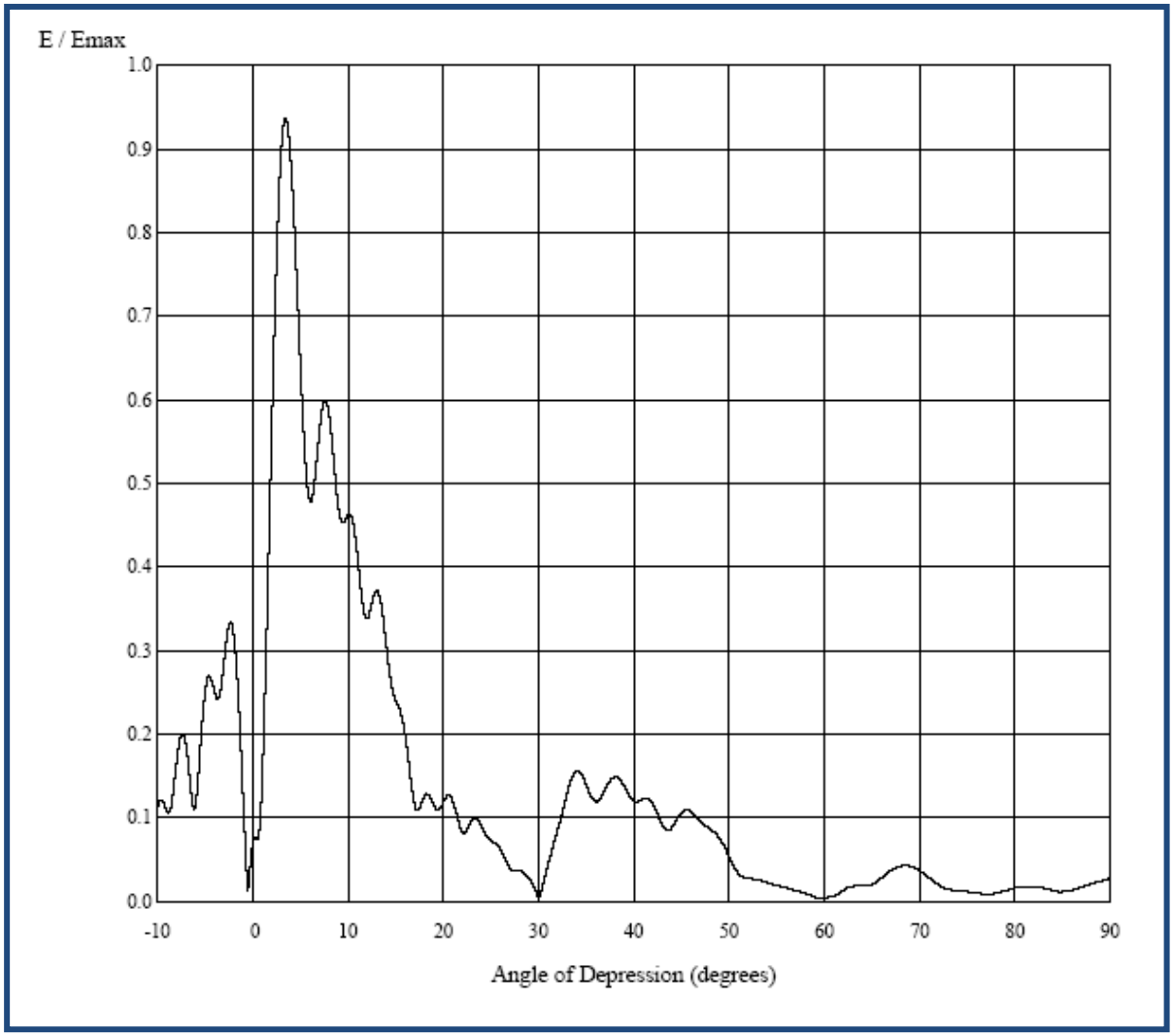

Figure 9a — Roxborough Elevation Relative Field Pattern

RFS PHP-40T

Relative Field at 135 degrees Azimuth Heading

Pattern Rotated to Actual Orientation

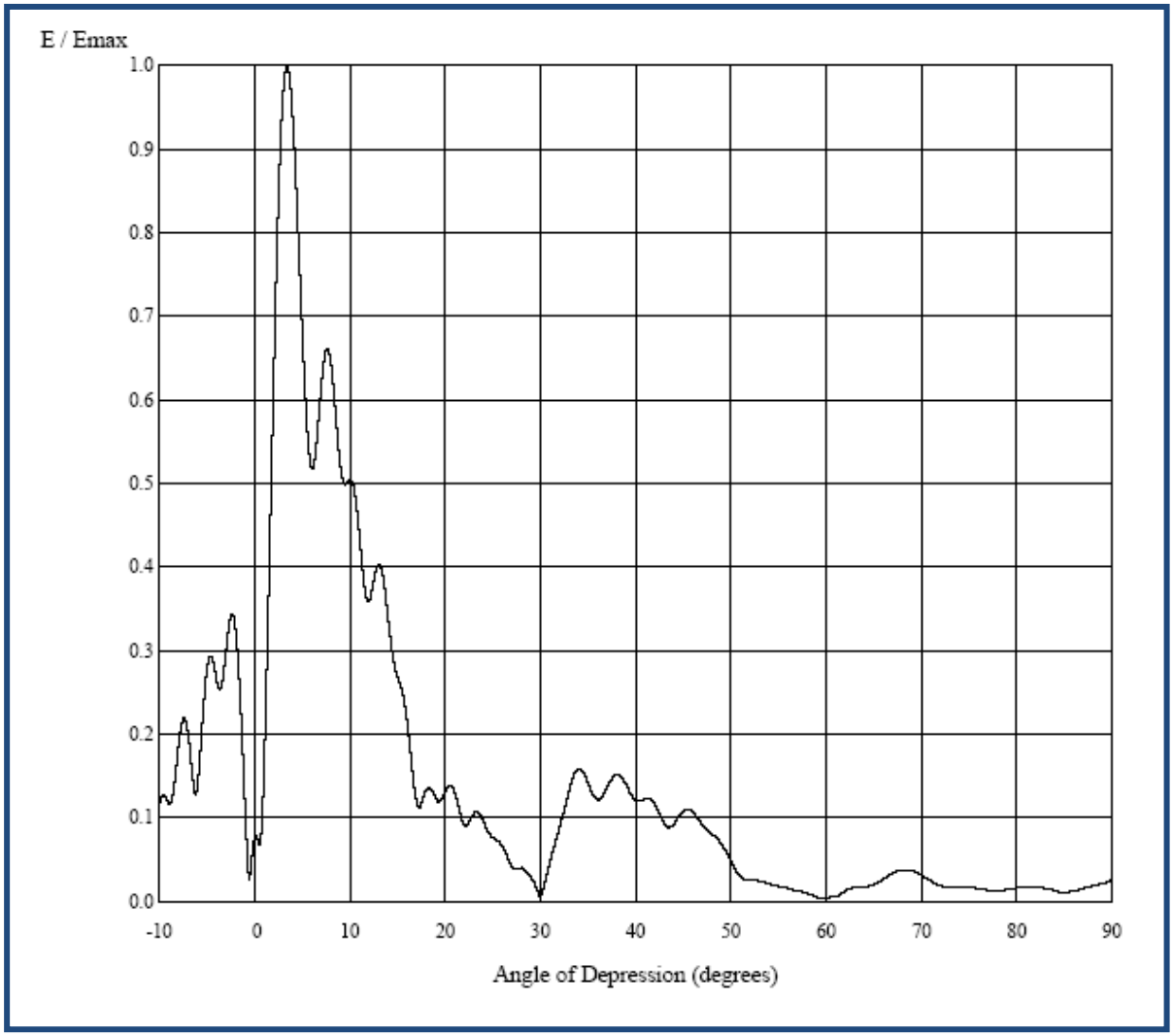

Figure 9b — Roxborough Elevation Relative Field Pattern

RFS PHP-40T

Relative Field at 225 degrees Azimuth Heading

Pattern Rotated to Actual Orientation

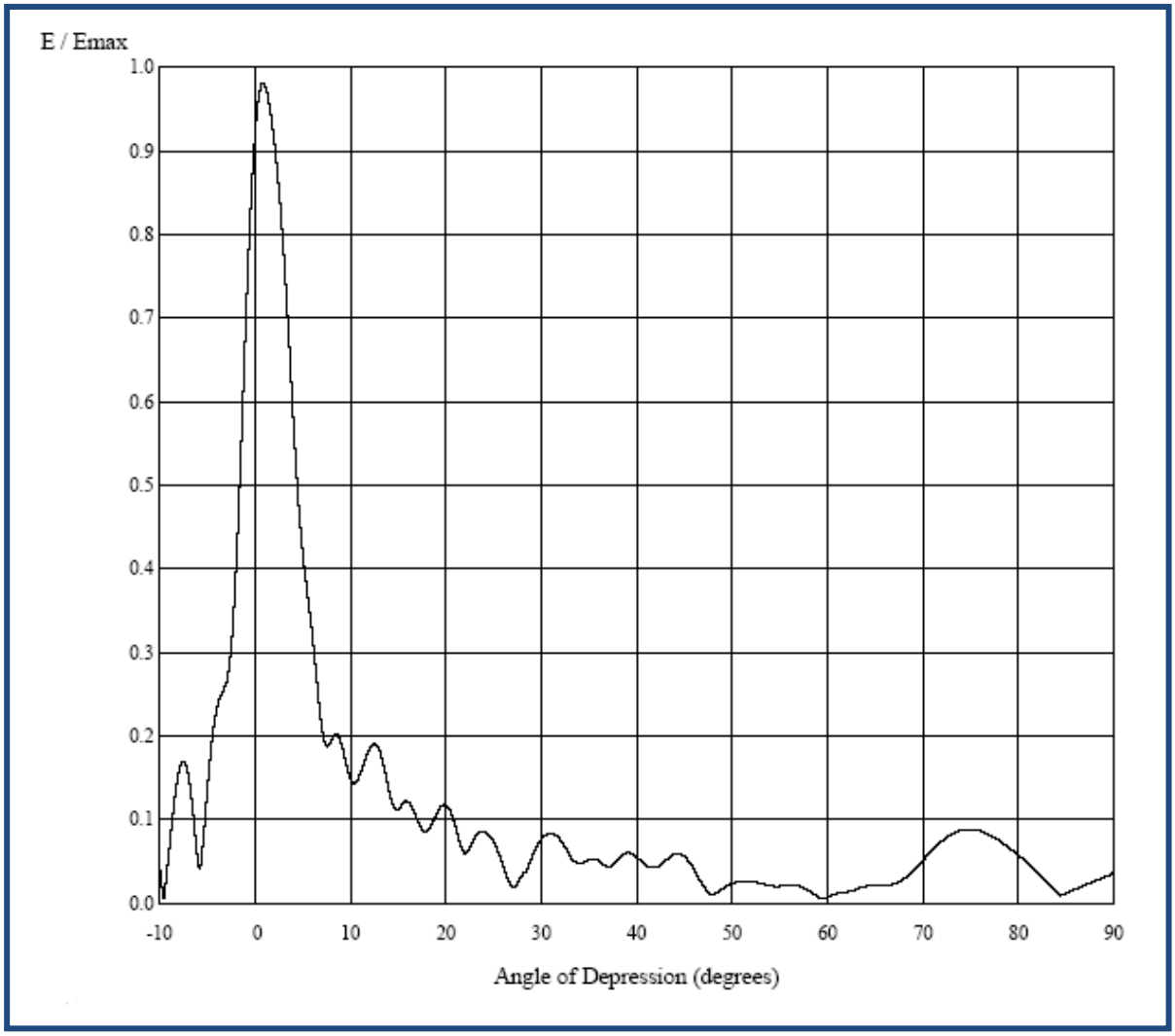

Figure 9c — Roxborough Elevation Relative Field Pattern

RFS PHP-40T

Relative Field at 315 degrees Azimuth Heading

Pattern Rotated to Actual Orientation

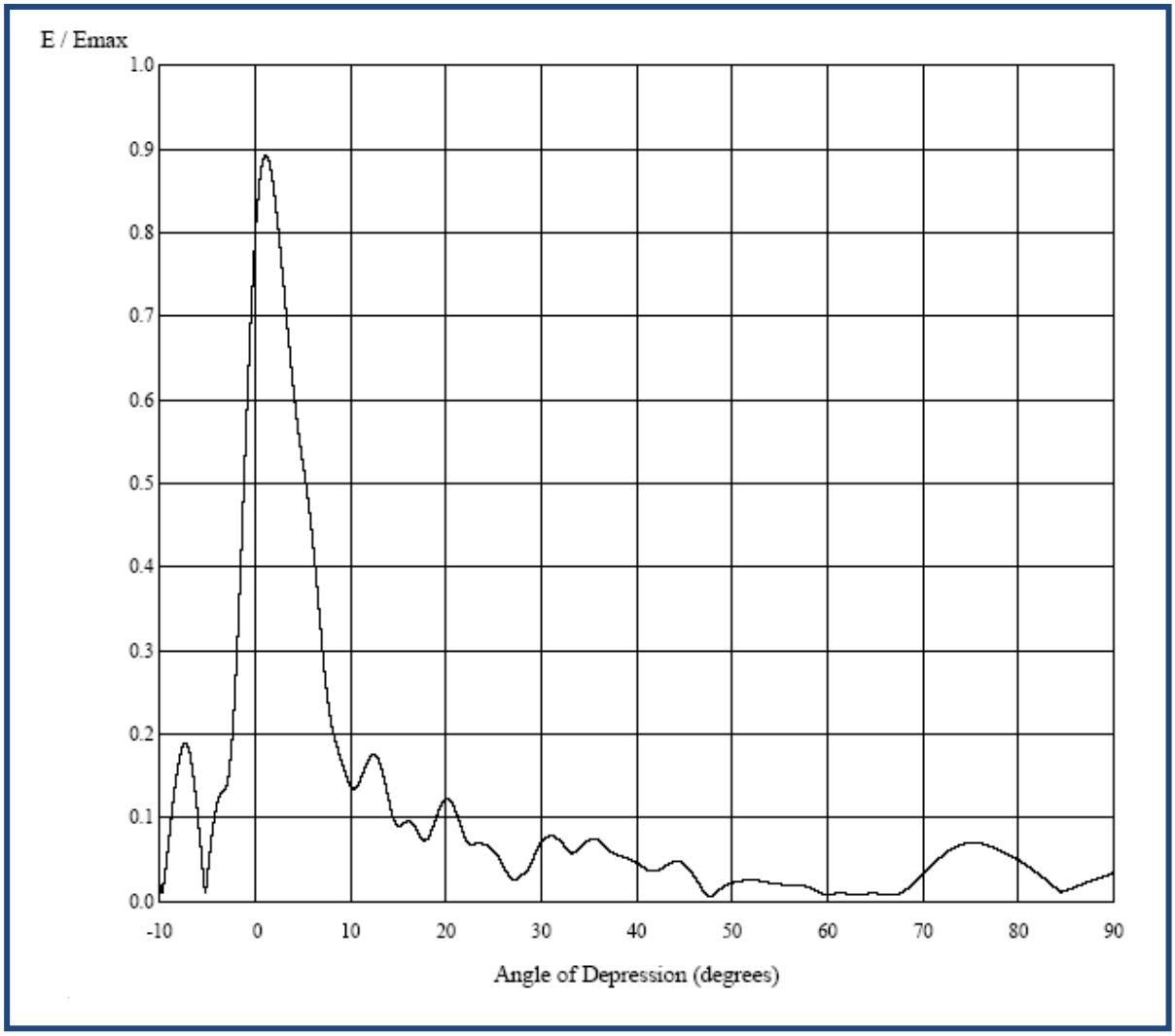

Figure 9d — Roxborough Elevation Relative Field Pattern

Figure 10 — Tabulated Data for RFS PHP-40T Elevation Relative Field Patterns – Roxborough

Depression	45 Az	135 Az	225 Az	315 Az	Depression	45 Az	135 Az	225 Az	315 Az	Depression	45 Az	135 Az	225 Az	315 Az
-5.0	0.2670	0.2772	0.1367	0.0305	1.4	0.3127	0.3277	0.9808	0.9951	6.8	0.5748	0.5888	0.2345	0.3782
-4.8	0.2819	0.2901	0.1634	0.0556	1.5	0.3593	0.3766	0.9756	0.9919	7.0	0.6002	0.6170	0.2156	0.3490
-4.6	0.2878	0.2937	0.1873	0.0789	1.6	0.4073	0.4253	0.9666	0.9850	7.2	0.6212	0.6388	0.2011	0.3205
-4.4	0.2855	0.2891	0.2077	0.0992	1.8	0.5059	0.5254	0.9496	0.9704	7.4	0.6354	0.6545	0.1932	0.2947
-4.2	0.2773	0.2785	0.2244	0.1159	2.0	0.6041	0.6248	0.9318	0.9533	7.5	0.6394	0.6602	0.1919	0.2833
-4.0	0.2670	0.2659	0.2372	0.1286	2.2	0.6974	0.7162	0.9089	0.9308	7.6	0.6409	0.6611	0.1913	0.2721
-3.8	0.2593	0.2560	0.2465	0.1375	2.4	0.7825	0.7994	0.8849	0.9072	7.8	0.6370	0.6581	0.1938	0.2532
-3.6	0.2588	0.2536	0.2530	0.1431	2.5	0.8212	0.8380	0.8732	0.8957	8.0	0.6242	0.6467	0.1987	0.2381
-3.4	0.2677	0.2612	0.2577	0.1463	2.6	0.8563	0.8704	0.8581	0.8816	8.2	0.6035	0.6252	0.2029	0.2256
-3.2	0.2852	0.2777	0.2622	0.1492	2.8	0.9161	0.9269	0.8283	0.8548	8.4	0.5778	0.5992	0.2057	0.2156
-3.0	0.3073	0.2989	0.2688	0.1547	3.0	0.9607	0.9693	0.7963	0.8280	8.5	0.5640	0.5862	0.2064	0.2115
-2.8	0.3293	0.3198	0.2798	0.1658	3.2	0.9885	0.9919	0.7587	0.7987	8.6	0.5500	0.5710	0.2057	0.2071
-2.6	0.3467	0.3358	0.2976	0.1856	3.4	1.000	1.000	0.7193	0.7705	8.8	0.5239	0.5442	0.2026	0.1991
-2.4	0.3559	0.3436	0.3239	0.2152	3.5	1.000	1.000	0.6999	0.7574	9.0	0.5029	0.5231	0.1968	0.1913
-2.2	0.3545	0.3407	0.3593	0.2545	3.6	0.9958	0.9928	0.6778	0.7427	9.2	0.4892	0.5072	0.1881	0.1829
-2.0	0.3415	0.3261	0.4032	0.3022	3.8	0.9773	0.9720	0.6352	0.7159	9.4	0.4835	0.5000	0.1782	0.1746
-1.8	0.3166	0.3000	0.4545	0.3567	4.0	0.9464	0.9411	0.5938	0.6913	9.5	0.4834	0.4998	0.1734	0.1707
-1.6	0.2809	0.2634	0.5113	0.4163	4.2	0.9048	0.8975	0.5523	0.6669	9.6	0.4844	0.4991	0.1681	0.1666
-1.4	0.2361	0.2183	0.5717	0.4794	4.4	0.8557	0.8487	0.5147	0.6452	9.8	0.4888	0.5015	0.1588	0.1596
-1.2	0.1849	0.1677	0.6337	0.5441	4.5	0.8292	0.8239	0.4982	0.6358	10.0	0.4933	0.5046	0.1518	0.1544
-1.0	0.1305	0.1150	0.6952	0.6090	4.6	0.8013	0.7954	0.4812	0.6253	10.2	0.4945	0.5027	0.1472	0.1510
-0.8	0.0766	0.0647	0.7543	0.6725	4.8	0.7444	0.7401	0.4522	0.6070	10.4	0.4903	0.4961	0.1459	0.1503
-0.6	0.0282	0.0276	0.8094	0.7331	5.0	0.6879	0.6867	0.4282	0.5902	10.5	0.4859	0.4913	0.1466	0.1511
-0.4	0.0229	0.0373	0.8589	0.7895	5.2	0.6342	0.6340	0.4062	0.5723	10.6	0.4796	0.4830	0.1475	0.1522
-0.2	0.0534	0.0614	0.9017	0.8405	5.4	0.5867	0.5886	0.3869	0.5544	10.8	0.4626	0.4637	0.1514	0.1561
0.0	0.0738	0.0758	0.9385	0.8863	5.5	0.5664	0.5702	0.3782	0.5456	11.0	0.4408	0.4405	0.1571	0.1619
0.2	0.0819	0.0772	0.9644	0.9230	5.6	0.5486	0.5524	0.3682	0.5352	11.2	0.4165	0.4137	0.1632	0.1683
0.4	0.0809	0.0699	0.9837	0.9532	5.8	0.5226	0.5281	0.3488	0.5140	11.4	0.3933	0.3894	0.1698	0.1751
0.5	0.0800	0.0672	0.992	0.9666	6.0	0.5108	0.5187	0.3284	0.4912	11.5	0.3833	0.3797	0.1734	0.1787
0.6	0.0819	0.0692	0.9954	0.9759	6.2	0.5128	0.5214	0.3053	0.4649	11.6	0.3747	0.3705	0.1764	0.1817
0.8	0.1042	0.0990	1.000	0.9910	6.4	0.5268	0.5370	0.2814	0.4372	11.8	0.3635	0.3600	0.1824	0.1876
1.0	0.1548	0.1588	1.000	0.9988	6.5	0.5372	0.5492	0.2697	0.4233	12.0	0.3609	0.3594	0.1878	0.1925
1.2	0.2267	0.2371	0.9917	1.000	6.6	0.5489	0.5610	0.2572	0.4080	12.2	0.3657	0.3656	0.1913	0.1954

Figure 10 – cont'd. — Tabulated Data for RFS PHP-40T Elevation Relative Field Patterns – Roxborough

Depression	45° Az	135° Az	225° Az	315° Az	Depression	45° Az	135° Az	225° Az	315° Az	Depression	45° Az	135° Az	225° Az	315° Az
12.4	0.3750	0.3770	0.1936	0.1968	17.8	0.1287	0.1269	0.0878	0.0816	23.4	0.1066	0.1071	0.0861	0.0776
12.5	0.3803	0.3839	0.1942	0.1970	18.0	0.1341	0.1331	0.0885	0.0828	23.5	0.1062	0.1066	0.0870	0.0776
12.6	0.3853	0.3892	0.1938	0.1961	18.2	0.1368	0.1360	0.0907	0.0861	23.6	0.1052	0.1052	0.0874	0.0774
12.8	0.3933	0.3988	0.1918	0.1933	18.4	0.1365	0.1360	0.0943	0.0914	23.8	0.1019	0.1015	0.0879	0.0771
13.0	0.3967	0.4041	0.1877	0.1884	18.5	0.1352	0.1352	0.0966	0.0947	24.0	0.0974	0.0968	0.0876	0.0765
13.2	0.3938	0.4016	0.1808	0.1810	18.6	0.1332	0.1332	0.0987	0.0980	24.2	0.0921	0.0912	0.0863	0.0755
13.4	0.3846	0.3934	0.1721	0.1718	18.8	0.1281	0.1286	0.1036	0.1054	24.4	0.0870	0.0859	0.0844	0.0742
13.5	0.3778	0.3877	0.1673	0.1669	19.0	0.1225	0.1240	0.1087	0.1130	24.5	0.0847	0.0837	0.0834	0.0735
13.6	0.3696	0.3793	0.1618	0.1612	19.2	0.1181	0.1202	0.1129	0.1200	24.6	0.0826	0.0815	0.0819	0.0725
13.8	0.3504	0.3610	0.1505	0.1494	19.4	0.1162	0.1193	0.1166	0.1263	24.8	0.0793	0.0782	0.0787	0.0704
14.0	0.3291	0.3411	0.1395	0.1375	19.5	0.1165	0.1202	0.1182	0.1292	25.0	0.0771	0.0762	0.0749	0.0679
14.2	0.3077	0.3201	0.1292	0.1258	19.6	0.1175	0.1213	0.1191	0.1315	25.2	0.0756	0.0747	0.0703	0.0648
14.4	0.2887	0.3018	0.1212	0.1156	19.8	0.1214	0.1257	0.1203	0.1352	25.4	0.0744	0.0735	0.0651	0.0612
14.5	0.2807	0.2945	0.1184	0.1114	20.0	0.1266	0.1312	0.1201	0.1374	25.5	0.0736	0.0729	0.0624	0.0593
14.6	0.2737	0.2871	0.1160	0.1076	20.2	0.1315	0.1358	0.1178	0.1376	25.6	0.0727	0.0719	0.0594	0.0572
14.8	0.2632	0.2763	0.1141	0.1025	20.4	0.1348	0.1388	0.1139	0.1361	25.8	0.0702	0.0695	0.0531	0.0527
15.0	0.2563	0.2690	0.1149	0.1004	20.5	0.1356	0.1396	0.1115	0.1349	26.0	0.0668	0.0662	0.0465	0.0481
15.2	0.2512	0.2621	0.1172	0.1005	20.6	0.1356	0.1392	0.1084	0.1329	26.2	0.0622	0.0617	0.0396	0.0432
15.4	0.2458	0.2550	0.1201	0.1022	20.8	0.1333	0.1365	0.1015	0.1282	26.4	0.0570	0.0566	0.0328	0.0385
15.5	0.2425	0.2511	0.1217	0.1035	21.0	0.1281	0.1312	0.0935	0.1223	26.5	0.0542	0.0540	0.0296	0.0364
15.6	0.2384	0.2456	0.1227	0.1046	21.2	0.1204	0.1230	0.0848	0.1151	26.6	0.0514	0.0513	0.0266	0.0343
15.8	0.2276	0.2328	0.1241	0.1067	21.4	0.1112	0.1136	0.0763	0.1074	26.8	0.0462	0.0463	0.0217	0.0310
16.0	0.2131	0.2166	0.1242	0.1079	21.5	0.1064	0.1090	0.0725	0.1037	27.0	0.0420	0.0424	0.0191	0.0290
16.2	0.1951	0.1963	0.1221	0.1077	21.6	0.1018	0.1042	0.0688	0.0997	27.2	0.0393	0.0398	0.0194	0.0284
16.4	0.1750	0.1743	0.1186	0.1061	21.8	0.0937	0.0963	0.0634	0.0925	27.4	0.0383	0.0388	0.0222	0.0292
16.5	0.1647	0.1634	0.1166	0.1050	22.0	0.0886	0.0914	0.0609	0.0862	27.5	0.0383	0.0389	0.0241	0.0301
16.6	0.1545	0.1522	0.1138	0.1032	22.2	0.0872	0.0900	0.0614	0.0812	27.6	0.0385	0.0390	0.0261	0.0311
16.8	0.1362	0.1327	0.1082	0.0993	22.4	0.0894	0.0921	0.0646	0.0779	27.8	0.0394	0.0396	0.0303	0.0335
17.0	0.1229	0.1190	0.1025	0.0947	22.5	0.0915	0.0942	0.0669	0.0770	28.0	0.0402	0.0402	0.0343	0.0362
17.2	0.1166	0.1126	0.0967	0.0899	22.6	0.0938	0.0962	0.0694	0.0763	28.2	0.0395	0.0392	0.0368	0.0375
17.4	0.1171	0.1138	0.0921	0.0857	22.8	0.0989	0.1009	0.0747	0.0761	28.4	0.0369	0.0364	0.0391	0.0383
17.5	0.1193	0.1166	0.0905	0.0841	23.0	0.1033	0.1049	0.0800	0.0769	28.5	0.0357	0.0353	0.0412	0.0399
17.6	0.1222	0.1197	0.0890	0.0827	23.2	0.1060	0.1069	0.0838	0.0776	28.6	0.0346	0.0340	0.0436	0.0418

Figure 10 – cont'd. — Tabulated Data for RFS PHP-40T Elevation Relative Field Patterns – Roxborough

Depression	45° Az	135° Az	225° Az	315° Az	Depression	45° Az	135° Az	225° Az	315° Az	Depression	45° Az	135° Az	225° Az	315° Az
28.8	0.0324	0.0317	0.0493	0.047	41.0	0.1307	0.1227	0.0463	0.0434	57.5	0.0124	0.0114	0.0186	0.021
29.0	0.0297	0.029	0.0553	0.053	41.5	0.1308	0.1228	0.0436	0.0408	58.0	0.0104	0.0095	0.0154	0.019
29.2	0.0264	0.0255	0.061	0.0591	42.0	0.1242	0.1169	0.0436	0.0405	58.5	0.0079	0.0073	0.0116	0.0161
29.4	0.022	0.0211	0.0663	0.0649	42.5	0.1114	0.1057	0.0466	0.0428	59.0	0.0055	0.005	0.0079	0.013
29.5	0.0194	0.0185	0.0688	0.0677	43.0	0.0975	0.0939	0.0516	0.0471	59.5	0.004	0.0036	0.0058	0.0102
29.6	0.0165	0.0157	0.0709	0.0703	43.5	0.0904	0.0886	0.0568	0.0513	60.0	0.0043	0.0039	0.007	0.0089
29.8	0.0101	0.0096	0.0748	0.075	44.0	0.0943	0.0927	0.0601	0.0538	60.5	0.0057	0.005	0.0097	0.0096
30.0	0.0046	0.0058	0.0782	0.079	44.5	0.1043	0.1016	0.0604	0.0534	61.0	0.0073	0.0063	0.0123	0.0114
30.2	0.0089	0.0105	0.0806	0.0822	45.0	0.1132	0.1087	0.057	0.0496	61.5	0.0103	0.0088	0.0132	0.0115
30.4	0.0176	0.0189	0.0825	0.0846	45.5	0.1167	0.1106	0.0502	0.0428	62.0	0.0145	0.0124	0.0138	0.0099
30.5	0.0223	0.0235	0.0834	0.0857	46.0	0.1144	0.1069	0.041	0.0338	62.5	0.0175	0.0151	0.0152	0.0089
30.6	0.0271	0.028	0.0839	0.0864	46.5	0.1084	0.0997	0.0307	0.0238	63.0	0.0193	0.0167	0.017	0.0088
30.8	0.0368	0.0373	0.0846	0.0874	47.0	0.1018	0.0919	0.0207	0.0139	63.5	0.0199	0.0174	0.019	0.0094
31.0	0.0464	0.0466	0.085	0.0879	47.5	0.0965	0.0857	0.0132	0.0065	64.0	0.0199	0.0177	0.0205	0.0102
31.5	0.0692	0.068	0.0831	0.0859	48.0	0.0924	0.0809	0.011	0.0081	64.5	0.0204	0.0183	0.0216	0.0107
32.0	0.0909	0.0881	0.0775	0.0805	48.5	0.0875	0.0758	0.014	0.0139	65.0	0.0221	0.02	0.0221	0.0107
32.5	0.1136	0.1093	0.0686	0.0731	49.0	0.0801	0.0689	0.018	0.019	65.5	0.0255	0.0229	0.0222	0.0101
33.0	0.1377	0.1322	0.0577	0.0657	49.5	0.0697	0.0594	0.0214	0.0227	66.0	0.0301	0.0266	0.0222	0.0091
33.5	0.1583	0.1515	0.0507	0.0656	50.0	0.0573	0.0483	0.0239	0.0251	66.5	0.035	0.0305	0.0226	0.0082
34.0	0.1662	0.1587	0.048	0.0703	50.5	0.045	0.0375	0.0255	0.0266	67.0	0.0394	0.0339	0.0238	0.0083
34.5	0.1617	0.1541	0.0497	0.0768	51.0	0.0355	0.0295	0.0266	0.0275	67.5	0.0429	0.0365	0.0262	0.0102
35.0	0.1488	0.1417	0.053	0.0822	51.5	0.0304	0.0258	0.0274	0.0284	68.0	0.045	0.0378	0.0299	0.0138
35.5	0.1348	0.1283	0.0542	0.0841	52.0	0.029	0.0252	0.0271	0.0287	68.5	0.0456	0.0379	0.0346	0.0185
36.0	0.1276	0.1215	0.0516	0.0819	52.5	0.0287	0.0253	0.0259	0.0283	69.0	0.0446	0.0368	0.0402	0.024
36.5	0.1315	0.1253	0.047	0.0764	53.0	0.0278	0.0245	0.0242	0.0274	69.5	0.0423	0.0345	0.0463	0.03
37.0	0.1427	0.1362	0.0445	0.0699	53.5	0.0259	0.0228	0.0225	0.0262	70.0	0.0388	0.0315	0.0526	0.0364
37.5	0.1538	0.1471	0.0474	0.0648	54.0	0.0237	0.0208	0.0212	0.025	70.5	0.0346	0.0279	0.0589	0.0428
38.0	0.1591	0.1522	0.0536	0.0619	54.5	0.0218	0.0192	0.0206	0.0238	71.0	0.0299	0.0243	0.065	0.0492
38.5	0.1561	0.1494	0.0592	0.0602	55.0	0.0204	0.018	0.0207	0.023	71.5	0.0253	0.0211	0.0708	0.0553
39.0	0.1465	0.1399	0.0614	0.0583	55.5	0.019	0.0169	0.0212	0.0224	72.0	0.0211	0.0186	0.076	0.061
39.5	0.1351	0.1285	0.06	0.0553	56.0	0.0171	0.0154	0.0216	0.0219	72.5	0.0177	0.0172	0.0805	0.066
40.0	0.128	0.121	0.0559	0.0514	56.5	0.0152	0.0139	0.0217	0.022	73.0	0.0153	0.0166	0.0843	0.0703
40.5	0.1277	0.1202	0.0508	0.0472	57.0	0.0139	0.0128	0.0208	0.0221	73.5	0.014	0.0167	0.0872	0.0737

Figure 10 – cont'd. — Tabulated Data for RFS PHP-40T Elevation Relative Field Patterns – Roxborough

Depression	45° Az	135° Az	225° Az	315° Az
74.0	0.0133	0.0169	0.0891	0.0762
74.5	0.0129	0.0170	0.0902	0.0778
75.0	0.0123	0.0167	0.0903	0.0785
75.5	0.0116	0.0161	0.0896	0.0784
76.0	0.0107	0.0152	0.0881	0.0776
76.5	0.0098	0.0142	0.0859	0.0761
77.0	0.0093	0.0133	0.0831	0.0740
77.5	0.0095	0.0128	0.0798	0.0716
78.0	0.0105	0.0128	0.0761	0.0687
78.5	0.0120	0.0132	0.0720	0.0655
79.0	0.0137	0.0141	0.0677	0.0621
79.5	0.0154	0.0152	0.0632	0.0586
80.0	0.0169	0.0161	0.0585	0.0550
80.5	0.0180	0.0169	0.0535	0.0511
81.0	0.0187	0.0174	0.0483	0.0469
81.5	0.0190	0.0175	0.0428	0.0424
82.0	0.0187	0.0172	0.0371	0.0376
82.5	0.0180	0.0166	0.0314	0.0326
83.0	0.0169	0.0156	0.0255	0.0274
83.5	0.0155	0.0143	0.0197	0.0220
84.0	0.0139	0.0127	0.0139	0.0166
84.5	0.0124	0.0113	0.0097	0.0127
85.0	0.0122	0.0110	0.0120	0.0149
85.5	0.0130	0.0115	0.0146	0.0172
86.0	0.0145	0.0126	0.0173	0.0197
86.5	0.0164	0.0140	0.0199	0.0222
87.0	0.0183	0.0156	0.0224	0.0246
87.5	0.0203	0.0172	0.0249	0.0270
88.0	0.0223	0.0187	0.0273	0.0292
88.5	0.0241	0.0202	0.0295	0.0314
89.0	0.0258	0.0216	0.0316	0.0335
89.5	0.0276	0.0231	0.0340	0.0358
90.0	0.0303	0.0254	0.0379	0.0400