

## **ENGINEERING EXHIBIT**

### **Application for Digital Television Station Auxiliary Antenna Construction Permit**

prepared for

**WWAY-TV, LLC**  
WWAY(DT) Wilmington NC  
Facility ID 12033  
Ch. 24 47 kW 212 m

*WWAY-TV, LLC* (“*WWAY-TV*”) is the licensee of digital television station WWAY(DT), Facility ID 12033, Channel 24, Wilmington NC. WWAY is licensed (file# 0000100423) to operate with a top-mounted directional antenna at 652 kW effective radiated power (“ERP”) and 590 meters height above average terrain (“HAAT”). A minor modification Construction Permit application is pending (file# 0000217743) for WWAY to implement a replacement top-mounted directional antenna at 700 kW ERP and 592 meters HAAT. *WWAY-TV* herein seeks authorization for an auxiliary antenna for WWAY.

The proposed auxiliary antenna is side-mounted on the same tower structure as the licensed main antenna and will operate at 47 kW ERP (directional) and an antenna HAAT of 212 meters. As with the main antenna, the auxiliary antenna will be shared with stations WECT Channel 23 and WSFX-TV Channel 29, both Wilmington NC.<sup>1</sup>

The WWAY tower structure is associated with FCC Antenna Structure Registration number 1008242. No change to the overall structure height will result from this proposal.

The proposed auxiliary antenna is an elliptically horizontally polarized directional Dielectric model TFU-16WB/VP-R C160 (57.5 percent vertical polarization). The maximum horizontally polarized ERP is 47 kW and the maximum vertically polarized ERP is 27 kW. The vertically polarized component will not exceed the horizontally polarized component at any azimuth. The directional antenna’s azimuthal patterns are supplied in Figures 1 and 1A for

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<sup>1</sup>WECT and WSFX-TV are already authorized to construct a side-mounted auxiliary antenna facility (file numbers 0000207212 and 0000207374).

horizontal and vertical polarization, respectively. The antenna's elevation pattern is depicted in Figure 2.

Figure 3 shows that the 41 dBμ noise limited service contour ("NLSC") of the proposed auxiliary facility does not extend beyond those of the licensed main and the proposed replacement main antenna facilities. Thus, the proposal complies with §73.1675(a).

### **Human Exposure to Radiofrequency Electromagnetic Field (Environmental)**

The proposed facility was evaluated for human exposure to RF energy using the procedures outlined in the FCC's OET Bulletin Number 65. Based on OET-65 equation (10) and 15 percent antenna relative field in downward elevations (pattern data shows 15 percent or less relative field at angles 25 to 90 degrees below the antenna), the calculated power density attributable to the proposed facility at locations near the transmitter site at a height of two meters above ground level is  $1.3 \mu\text{W}/\text{cm}^2$ , which is 0.4 percent of the general population / uncontrolled maximum permissible exposure limit. This is well below the five percent threshold limit described in §1.1307(b) regarding sites with multiple emitters, categorically excluding the applicant from responsibility for taking any corrective action in the areas where the proposal's contribution is less than five percent.

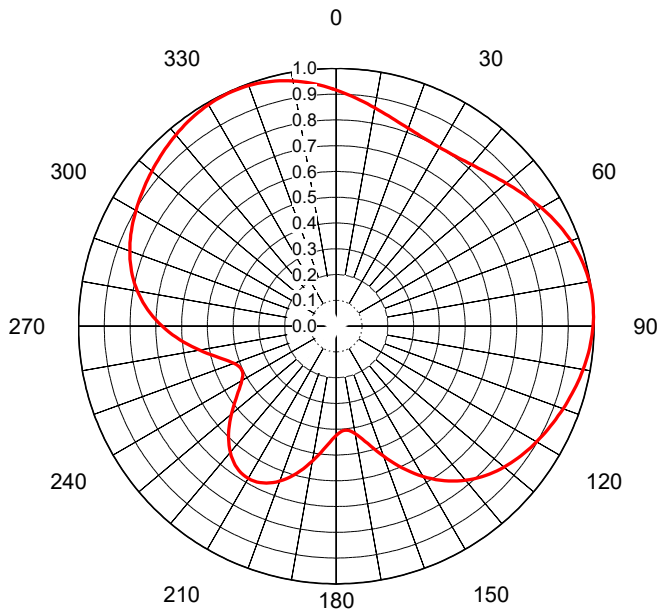
The general public will not be exposed to RF levels attributable to the proposal in excess of the FCC's guidelines. RF exposure warning signs will continue to be posted. With respect to worker safety, the applicant will coordinate exposure procedures with all pertinent stations and will reduce power or cease operation as necessary to protect persons having access to the site, tower, or antenna from RF electromagnetic field exposure in excess of FCC guidelines. This exhibit is limited to the evaluation of exposure to RF electromagnetic field. No increase in structure height is proposed.

*List of Attachments*

Figure 1, 1A    Antenna Azimuthal Pattern  
Figure 2        Antenna Elevation Pattern  
Figure 3        Proposed Auxiliary Contours  
Form 2100      Saved Version of Engineering Sections of FCC Form at Time of Upload

**Chesapeake RF Consultants, LLC**

Joseph M. Davis, P.E.        July 11, 2023  
207 Old Dominion Road       Yorktown, VA 23692       703-650-9600



## AZIMUTH PATTERN Horizontal Polarization

Proposal No. **20230110jmd**  
Date **10-Jan-23**  
Call Letters **WWAY**  
Channel **24**  
Frequency **533 MHz**  
Antenna Type **TFU-16WB/VP-R C160**  
Gain **1.57 (1.96dB)**  
Calculated

Pattern Number **WB-C160-24 Hpol**

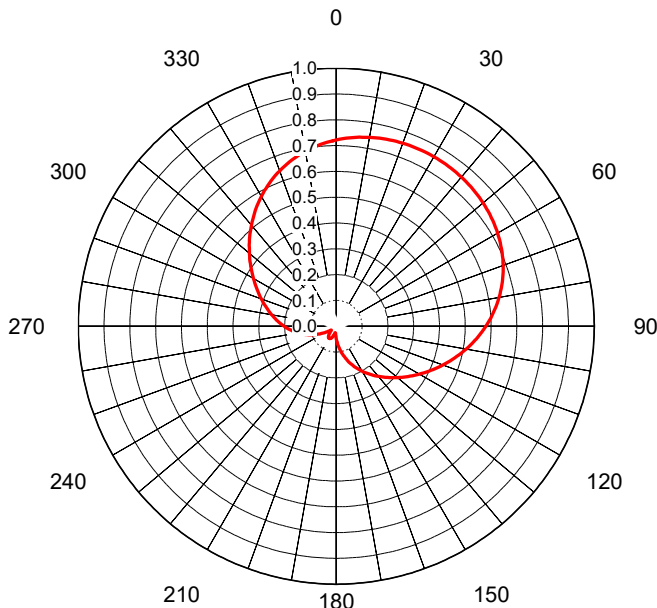
Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value
0	0.916	36	0.807	72	0.976	108	0.944	144	0.743	180	0.424	216	0.667	252	0.439	288	0.841
1	0.910	37	0.809	73	0.980	109	0.941	145	0.732	181	0.432	217	0.661	253	0.449	289	0.847
2	0.905	38	0.812	74	0.983	110	0.937	146	0.721	182	0.440	218	0.655	254	0.460	290	0.853
3	0.899	39	0.815	75	0.986	111	0.933	147	0.710	183	0.450	219	0.647	255	0.471	291	0.858
4	0.893	40	0.818	76	0.989	112	0.929	148	0.698	184	0.460	220	0.640	256	0.484	292	0.863
5	0.888	41	0.821	77	0.991	113	0.925	149	0.686	185	0.471	221	0.631	257	0.497	293	0.868
6	0.882	42	0.825	78	0.993	114	0.922	150	0.674	186	0.483	222	0.622	258	0.510	294	0.872
7	0.876	43	0.828	79	0.995	115	0.918	151	0.661	187	0.494	223	0.612	259	0.524	295	0.877
8	0.871	44	0.833	80	0.997	116	0.914	152	0.648	188	0.507	224	0.601	260	0.538	296	0.881
9	0.865	45	0.837	81	0.998	117	0.910	153	0.635	189	0.519	225	0.590	261	0.552	297	0.885
10	0.860	46	0.842	82	0.999	118	0.906	154	0.621	190	0.531	226	0.579	262	0.566	298	0.890
11	0.855	47	0.846	83	1.000	119	0.902	155	0.607	191	0.544	227	0.567	263	0.580	299	0.894
12	0.850	48	0.851	84	1.000	120	0.898	156	0.593	192	0.556	228	0.555	264	0.595	300	0.897
13	0.845	49	0.856	85	1.000	121	0.894	157	0.579	193	0.568	229	0.543	265	0.609	301	0.901
14	0.840	50	0.862	86	1.000	122	0.889	158	0.565	194	0.580	230	0.531	266	0.623	302	0.905
15	0.836	51	0.867	87	0.999	123	0.885	159	0.551	195	0.591	231	0.518	267	0.636	303	0.909
16	0.831	52	0.873	88	0.999	124	0.881	160	0.537	196	0.602	232	0.506	268	0.650	304	0.912
17	0.827	53	0.878	89	0.998	125	0.876	161	0.524	197	0.612	233	0.494	269	0.663	305	0.916
18	0.824	54	0.884	90	0.996	126	0.871	162	0.510	198	0.622	234	0.482	270	0.676	306	0.920
19	0.820	55	0.890	91	0.995	127	0.866	163	0.497	199	0.631	235	0.470	271	0.688	307	0.923
20	0.817	56	0.895	92	0.993	128	0.861	164	0.484	200	0.640	236	0.459	272	0.701	308	0.927
21	0.814	57	0.901	93	0.991	129	0.856	165	0.472	201	0.648	237	0.449	273	0.712	309	0.931
22	0.811	58	0.907	94	0.989	130	0.851	166	0.460	202	0.655	238	0.439	274	0.724	310	0.934
23	0.809	59	0.913	95	0.987	131	0.845	167	0.450	203	0.661	239	0.430	275	0.735	311	0.938
24	0.807	60	0.918	96	0.984	132	0.839	168	0.440	204	0.667	240	0.423	276	0.745	312	0.941
25	0.805	61	0.924	97	0.981	133	0.833	169	0.431	205	0.672	241	0.416	277	0.755	313	0.945
26	0.803	62	0.930	98	0.979	134	0.827	170	0.423	206	0.675	242	0.411	278	0.765	314	0.948
27	0.802	63	0.935	99	0.976	135	0.820	171	0.417	207	0.679	243	0.407	279	0.775	315	0.952
28	0.801	64	0.940	100	0.972	136	0.813	172	0.412	208	0.681	244	0.405	280	0.783	316	0.955
29	0.801	65	0.946	101	0.969	137	0.805	173	0.408	209	0.682	245	0.404	281	0.792	317	0.959
30	0.801	66	0.951	102	0.966	138	0.797	174	0.406	210	0.682	246	0.405	282	0.800	318	0.962
31	0.801	67	0.955	103	0.962	139	0.789	175	0.406	211	0.682	247	0.407	283	0.808	319	0.965
32	0.802	68	0.960	104	0.959	140	0.781	176	0.406	212	0.681	248	0.411	284	0.815	320	0.968
33	0.802	69	0.964	105	0.955	141	0.772	177	0.409	213	0.678	249	0.416	285	0.822	321	0.971
34	0.804	70	0.969	106	0.952	142	0.762	178	0.413	214	0.675	250	0.422	286	0.829	322	0.974
35	0.805	71	0.973	107	0.948	143	0.753	179	0.418	215	0.671	251	0.430	287	0.835	323	0.977



**Figure 1**  
**Auxiliary Antenna Azimuthal Pattern**  
**Horizontal Polarization**  
**WWAY(DT) Wilmington NC**  
**Facility ID 12033**  
**Ch. 24 47 kW 212 m**

prepared for  
**WWAY-TV, LLC**

July, 2023

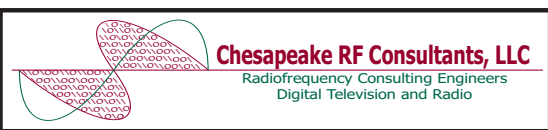


## AZIMUTH PATTERN Vertical Polarization

Proposal No. **20230110jmd**  
Date **10-Jan-23**  
Call Letters **WWAY**  
Channel **24**  
Frequency **533 MHz**  
Antenna Type **TFU-16WB/VP-R C160**  
Gain **2.6 (4.15dB)**  
Calculated

Pattern Number **WB-C160-24 Vpol**

Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value
0	0.722	36	0.757	72	0.680	108	0.454	144	0.233	180	0.047	216	0.051	252	0.107	288	0.298
1	0.725	37	0.757	73	0.676	109	0.447	145	0.228	181	0.043	217	0.050	253	0.113	289	0.303
2	0.727	38	0.756	74	0.671	110	0.440	146	0.222	182	0.039	218	0.048	254	0.118	290	0.309
3	0.730	39	0.755	75	0.666	111	0.433	147	0.217	183	0.035	219	0.047	255	0.123	291	0.315
4	0.732	40	0.755	76	0.662	112	0.426	148	0.212	184	0.032	220	0.045	256	0.129	292	0.321
5	0.734	41	0.754	77	0.657	113	0.419	149	0.207	185	0.029	221	0.043	257	0.134	293	0.327
6	0.736	42	0.753	78	0.652	114	0.412	150	0.202	186	0.027	222	0.041	258	0.139	294	0.333
7	0.738	43	0.752	79	0.646	115	0.405	151	0.197	187	0.026	223	0.039	259	0.145	295	0.339
8	0.740	44	0.751	80	0.641	116	0.398	152	0.191	188	0.025	224	0.037	260	0.150	296	0.345
9	0.742	45	0.750	81	0.635	117	0.391	153	0.186	189	0.025	225	0.034	261	0.155	297	0.352
10	0.743	46	0.749	82	0.630	118	0.385	154	0.181	190	0.026	226	0.032	262	0.161	298	0.358
11	0.745	47	0.748	83	0.624	119	0.378	155	0.176	191	0.027	227	0.030	263	0.166	299	0.364
12	0.746	48	0.746	84	0.618	120	0.371	156	0.171	192	0.029	228	0.028	264	0.171	300	0.371
13	0.748	49	0.745	85	0.612	121	0.365	157	0.165	193	0.031	229	0.026	265	0.176	301	0.377
14	0.749	50	0.743	86	0.606	122	0.359	158	0.160	194	0.033	230	0.025	266	0.182	302	0.384
15	0.750	51	0.742	87	0.600	123	0.352	159	0.155	195	0.035	231	0.024	267	0.187	303	0.391
16	0.751	52	0.740	88	0.593	124	0.346	160	0.150	196	0.037	232	0.024	268	0.192	304	0.398
17	0.752	53	0.738	89	0.587	125	0.340	161	0.144	197	0.039	233	0.025	269	0.197	305	0.404
18	0.753	54	0.736	90	0.580	126	0.334	162	0.139	198	0.041	234	0.026	270	0.202	306	0.411
19	0.754	55	0.734	91	0.574	127	0.327	163	0.134	199	0.043	235	0.028	271	0.208	307	0.418
20	0.755	56	0.732	92	0.567	128	0.321	164	0.128	200	0.045	236	0.031	272	0.213	308	0.425
21	0.755	57	0.730	93	0.560	129	0.315	165	0.123	201	0.047	237	0.035	273	0.218	309	0.432
22	0.756	58	0.727	94	0.553	130	0.310	166	0.118	202	0.049	238	0.038	274	0.223	310	0.440
23	0.757	59	0.725	95	0.546	131	0.304	167	0.112	203	0.050	239	0.042	275	0.228	311	0.447
24	0.757	60	0.722	96	0.540	132	0.298	168	0.107	204	0.051	240	0.047	276	0.233	312	0.454
25	0.757	61	0.719	97	0.533	133	0.292	169	0.102	205	0.053	241	0.051	277	0.238	313	0.461
26	0.758	62	0.717	98	0.525	134	0.287	170	0.096	206	0.053	242	0.056	278	0.244	314	0.468
27	0.758	63	0.714	99	0.518	135	0.281	171	0.091	207	0.054	243	0.061	279	0.249	315	0.475
28	0.758	64	0.710	100	0.511	136	0.276	172	0.086	208	0.055	244	0.065	280	0.254	316	0.483
29	0.758	65	0.707	101	0.504	137	0.270	173	0.081	209	0.055	245	0.070	281	0.259	317	0.490
30	0.758	66	0.704	102	0.497	138	0.265	174	0.076	210	0.055	246	0.076	282	0.265	318	0.497
31	0.758	67	0.700	103	0.490	139	0.259	175	0.071	211	0.055	247	0.081	283	0.270	319	0.504
32	0.758	68	0.696	104	0.483	140	0.254	176	0.066	212	0.055	248	0.086	284	0.276	320	0.512
33	0.758	69	0.693	105	0.475	141	0.249	177	0.061	213	0.054	249	0.091	285	0.281	321	0.519
34	0.758	70	0.689	106	0.468	142	0.243	178	0.056	214	0.053	250	0.097	286	0.287	322	0.526
35	0.757	71	0.684	107	0.461	143	0.238	179	0.051	215	0.052	251	0.102	287	0.292	323	0.533



**Figure 1A**  
**Auxiliary Antenna Azimuthal Pattern**  
**Vertical Polarization**  
**WWAY(DT) Wilmington NC**  
**Facility ID 12033**  
**Ch. 24 47 kW 212 m**

prepared for  
**WWAY-TV, LLC**

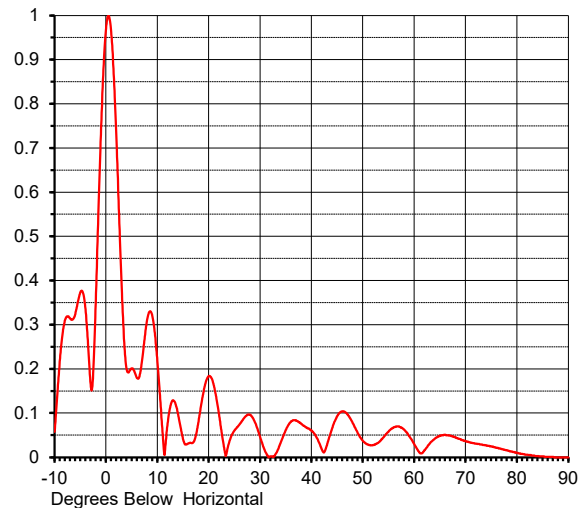
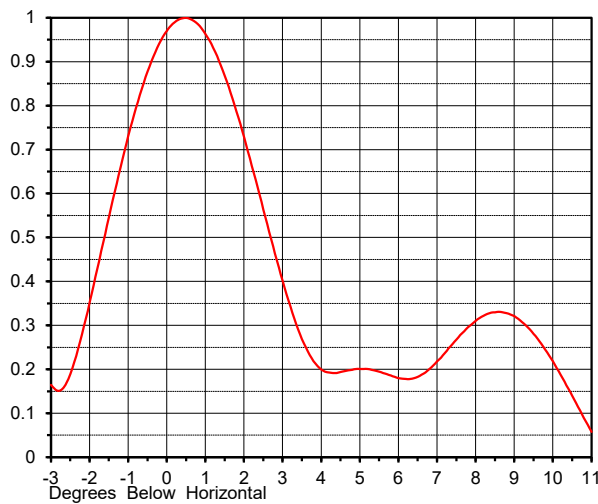
July, 2023

## ELEVATION PATTERN

Proposal No. **20230110jmd**  
 Date **10-Jan-23**  
 Call Letters **WWAY**  
 Channel **24**  
 Frequency **533 MHz**  
 Antenna Type **TFU-16WB/VP-R C160**

RMS Directivity at Main Lobe **14.4 ( 11.58 dB )**  
 RMS Directivity at Horizontal **13.6 ( 11.34 dB )**  
**Calculated**

Beam Tilt **0.55 deg**  
 Pattern Number **16W144055-24**



Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.058	10.0	0.218	30.0	0.046	50.0	0.037	70.0	0.037
-9.0	0.217	11.0	0.058	31.0	0.013	51.0	0.029	71.0	0.033
-8.0	0.310	12.0	0.077	32.0	0.002	52.0	0.028	72.0	0.031
-7.0	0.315	13.0	0.129	33.0	0.007	53.0	0.033	73.0	0.029
-6.0	0.324	14.0	0.099	34.0	0.033	54.0	0.045	74.0	0.027
-5.0	0.374	15.0	0.041	35.0	0.062	55.0	0.058	75.0	0.025
-4.0	0.335	16.0	0.031	36.0	0.081	56.0	0.068	76.0	0.022
-3.0	0.165	17.0	0.034	37.0	0.083	57.0	0.070	77.0	0.019
-2.0	0.352	18.0	0.081	38.0	0.076	58.0	0.063	78.0	0.016
-1.0	0.731	19.0	0.149	39.0	0.068	59.0	0.049	79.0	0.013
0.0	0.971	20.0	0.184	40.0	0.061	60.0	0.030	80.0	0.010
1.0	0.963	21.0	0.162	41.0	0.045	61.0	0.011	81.0	0.008
2.0	0.728	22.0	0.097	42.0	0.018	62.0	0.016	82.0	0.006
3.0	0.401	23.0	0.021	43.0	0.027	63.0	0.031	83.0	0.004
4.0	0.200	24.0	0.035	44.0	0.065	64.0	0.042	84.0	0.003
5.0	0.201	25.0	0.061	45.0	0.093	65.0	0.049	85.0	0.002
6.0	0.180	26.0	0.075	46.0	0.104	66.0	0.051	86.0	0.001
7.0	0.218	27.0	0.091	47.0	0.097	67.0	0.049	87.0	0.001
8.0	0.311	28.0	0.096	48.0	0.078	68.0	0.045	88.0	0.000
9.0	0.321	29.0	0.079	49.0	0.055	69.0	0.041	89.0	0.000
								90.0	0.000



**Figure 2**  
**Auxiliary Antenna Elevation Pattern**  
**WWAY(DT) Wilmington NC**  
**Facility ID 12033**  
**Ch. 24 47 kW 212 m**

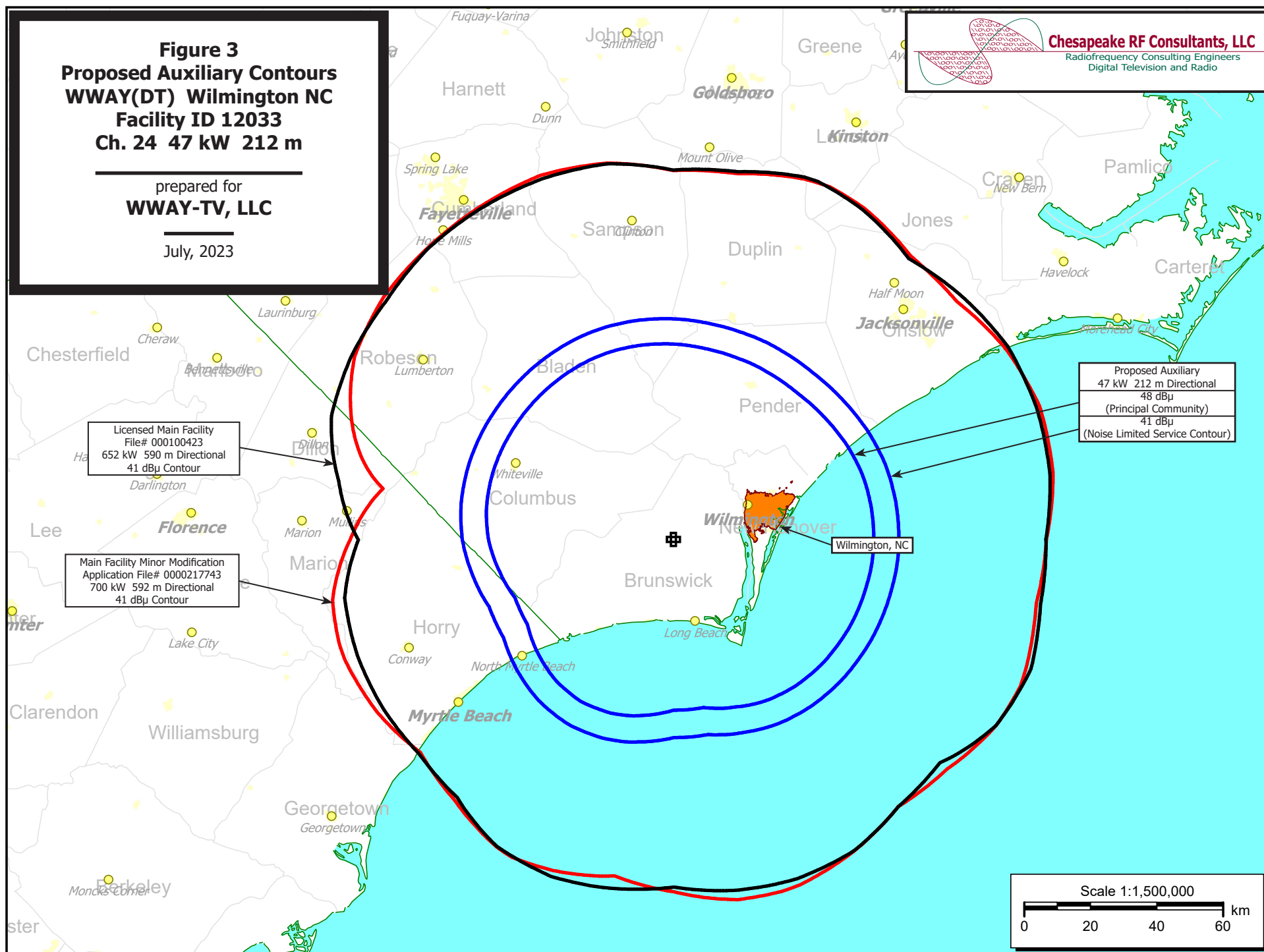
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**Figure 3**  
**Proposed Auxiliary Contours**  
**WWAY(DT) Wilmington NC**  
**Facility ID 12033**  
**Ch. 24 47 kW 212 m**

prepared for  
**WWAY-TV, LLC**

July, 2023



Channel and  
Facility  
Information

Section	Question	Response
Proposed Community of License	Facility ID	12033
	State	North Carolina
	City	WILMINGTON
	DTX Channel	24
	Designated Market Area	Wilmington
Facility Type	Facility Type	Commercial
	Station Type	Auxiliary
Zone	Zone	2



Antenna Location  
Data

Section	Question	Response
Antenna Structure Registration	Do you have an FCC Antenna Structure Registration (ASR) Number?	Yes
	ASR Number	1008242
Coordinates (NAD83)	Latitude	34° 07' 54.0" N+
	Longitude	078° 11' 16.0" W-
	Structure Type	GTOWER-Guyed Structure Used for Communication Purposes
	Overall Structure Height	595.6 meters
	Support Structure Height	548.0 meters
	Ground Elevation (AMSL)	19.2 meters
Antenna Data	Height of Radiation Center Above Ground Level	207.9 meters
	Height of Radiation Center Above Average Terrain	211.9 meters
	Height of Radiation Center Above Mean Sea Level	227.1 meters
	Effective Radiated Power	47 kW

**Antenna  
Technical Data**

Section	Question	Response
Antenna Type	Antenna Type	Directional Custom
	Do you have an Antenna ID?	No
	Antenna ID	
Antenna Manufacturer and Model	Manufacturer:	Dielectric
	Model	TFU-16WB/VP-R C160
	Rotation	30 degrees
	Electrical Beam Tilt	0.55
	Mechanical Beam Tilt	Not Applicable
	toward azimuth	
	Polarization	Elliptical
DTV and DTS: Elevation Pattern	Does the proposed antenna propose elevation radiation patterns that vary with azimuth for reasons other than the use of mechanical beam tilt?	No
	Uploaded file for elevation antenna (or radiation) pattern data	

**Directional Antenna Relative Field Values (Pre-rotated Pattern)**

Degree	Value	Degree	Value	Degree	Value	Degree	Value
0	0.801	90	0.898	180	0.683	270	0.897
10	0.818	100	0.851	190	0.640	280	0.934
20	0.862	110	0.781	200	0.531	290	0.968
30	0.918	120	0.674	210	0.423	300	0.992
40	0.969	130	0.537	220	0.422	310	0.993
50	0.997	140	0.423	230	0.538	320	0.966
60	0.996	150	0.424	240	0.676	330	0.916
70	0.973	160	0.531	250	0.783	340	0.860
80	0.937	170	0.640	260	0.853	350	0.817

**Additional Azimuths**

Degree	V <sub>A</sub>
55	1.000
305	0.996