

**Antenna Model:****TFU-21JTH/VP-R 04**

Proposal Number: **C-70678-4**  
Date: **26-Jun-17**  
Customer: **WEAO**  
Location: **Akron, OH**

**Electrical Specifications**

Polarization: **Elliptical**  
Azimuth Pattern: **Omni**  
Antenna Input: **6-1/8"** **75 Ohm** **EIA/DCA**  
VSWR: **Channel** **1.08 : 1**  
Bandwidth: **6 MHz**  
Rated Input Power: **59 kW** **(17.71 dBk)** **Maximum Average Power**

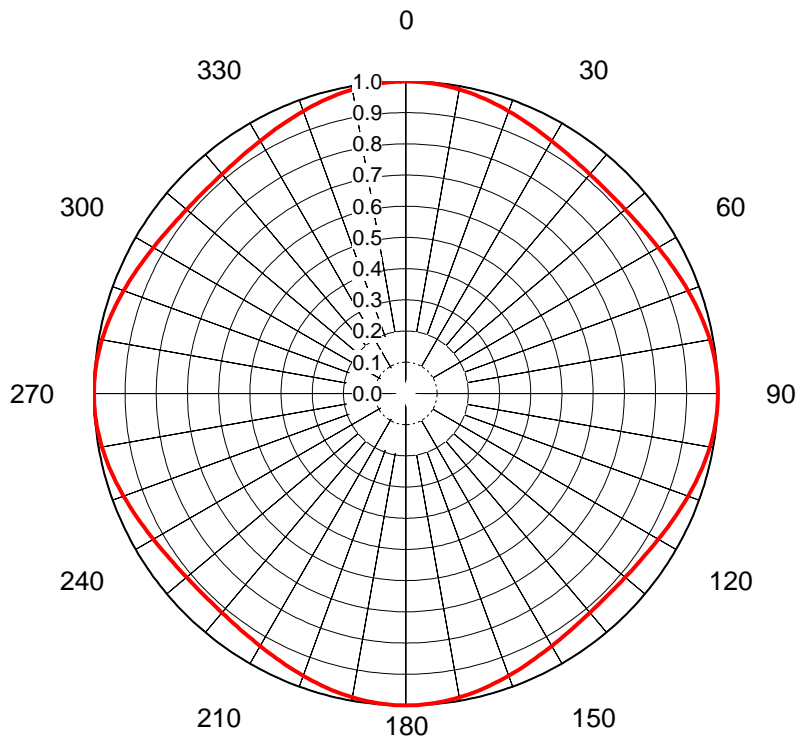
**Mechanical Specifications**

Mounting: **Top Mounted**  
Environmental Protection: **Full Radome**  
Height: **43 ft (13.1m)** less Lightning Protector **46 ft (14m)** with Lightning Protector  
Weight: **6500 lb (2.9t)**  
Effective Projected Area: **45.8 ft² (4.3m²)** **TIA-222-G** Basic Wind Speed: **90 m/h (144.8 km/h)**

**Channel Specifications**

Call	CH	Freq	Hpol ERP	Vpol ERP	TPO	RMS Main Lobe Hpol Gain	RMS Main Lobe Vpol Gain	RMS at Horizontal Hpol Gain	RMS at Horizontal Vpol Gain
WEAO	24	533 MHz	150 kW (21.76 dBk)	50.0 kW (16.99 dBk)	13.5 kW (11.32 dBk)	14.25 (11.54dB)	4.75 (6.76dB)	12.76 (11.06dB)	4.25 (6.28dB)

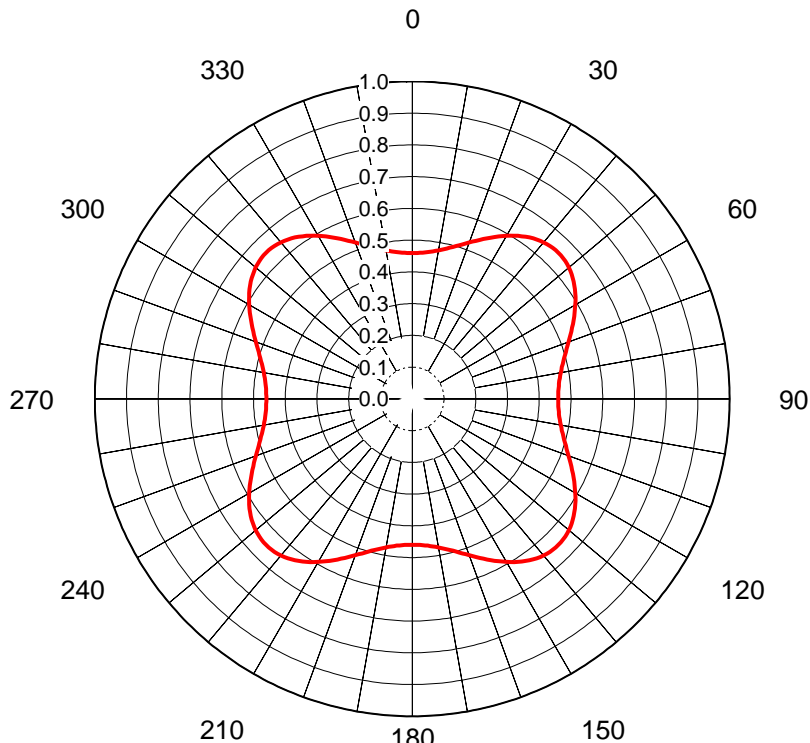
## AZIMUTH PATTERN Horizontal Polarization



Proposal No. **C-70678-4**  
 Date **26-Jun-17**  
 Call Letters **WEAO**  
 Channel **24**  
 Frequency **533 MHz**  
 Antenna Type **TFU-21JTH/VP-R O4**  
 Gain **1.09 (0.38dB)**  
 Calculated  
 Circularity **+/- 1.0 dB**

Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value
0	1.000	36	0.922	72	0.969	108	0.969	144	0.922	180	1.000	216	0.922	252	0.969	288	0.969
1	1.000	37	0.921	73	0.972	109	0.966	145	0.924	181	1.000	217	0.921	253	0.972	289	0.966
2	1.000	38	0.919	74	0.974	110	0.963	146	0.926	182	1.000	218	0.919	254	0.974	290	0.963
3	0.999	39	0.918	75	0.977	111	0.960	147	0.928	183	0.999	219	0.918	255	0.977	291	0.960
4	0.998	40	0.917	76	0.980	112	0.957	148	0.930	184	0.998	220	0.917	256	0.980	292	0.957
5	0.997	41	0.917	77	0.982	113	0.954	149	0.932	185	0.997	221	0.917	257	0.982	293	0.954
6	0.996	42	0.916	78	0.985	114	0.951	150	0.935	186	0.996	222	0.916	258	0.985	294	0.951
7	0.994	43	0.915	79	0.987	115	0.948	151	0.937	187	0.994	223	0.915	259	0.987	295	0.948
8	0.993	44	0.915	80	0.989	116	0.945	152	0.940	188	0.993	224	0.915	260	0.989	296	0.945
9	0.991	45	0.915	81	0.991	117	0.942	153	0.942	189	0.991	225	0.915	261	0.991	297	0.942
10	0.989	46	0.915	82	0.993	118	0.940	154	0.945	190	0.989	226	0.915	262	0.993	298	0.940
11	0.987	47	0.915	83	0.994	119	0.937	155	0.948	191	0.987	227	0.915	263	0.994	299	0.937
12	0.985	48	0.916	84	0.996	120	0.935	156	0.951	192	0.985	228	0.916	264	0.996	300	0.935
13	0.982	49	0.917	85	0.997	121	0.932	157	0.954	193	0.982	229	0.917	265	0.997	301	0.932
14	0.980	50	0.917	86	0.998	122	0.930	158	0.957	194	0.980	230	0.917	266	0.998	302	0.930
15	0.977	51	0.918	87	0.999	123	0.928	159	0.960	195	0.977	231	0.918	267	0.999	303	0.928
16	0.974	52	0.919	88	1.000	124	0.926	160	0.963	196	0.974	232	0.919	268	1.000	304	0.926
17	0.972	53	0.921	89	1.000	125	0.924	161	0.966	197	0.972	233	0.921	269	1.000	305	0.924
18	0.969	54	0.922	90	1.000	126	0.922	162	0.969	198	0.969	234	0.922	270	1.000	306	0.922
19	0.966	55	0.924	91	1.000	127	0.921	163	0.972	199	0.966	235	0.924	271	1.000	307	0.921
20	0.963	56	0.926	92	1.000	128	0.919	164	0.974	200	0.963	236	0.926	272	1.000	308	0.919
21	0.960	57	0.928	93	0.999	129	0.918	165	0.977	201	0.960	237	0.928	273	0.999	309	0.918
22	0.957	58	0.930	94	0.998	130	0.917	166	0.980	202	0.957	238	0.930	274	0.998	310	0.917
23	0.954	59	0.932	95	0.997	131	0.917	167	0.982	203	0.954	239	0.932	275	0.997	311	0.917
24	0.951	60	0.935	96	0.996	132	0.916	168	0.985	204	0.951	240	0.935	276	0.996	312	0.916
25	0.948	61	0.937	97	0.994	133	0.915	169	0.987	205	0.948	241	0.937	277	0.994	313	0.915
26	0.945	62	0.940	98	0.993	134	0.915	170	0.989	206	0.945	242	0.940	278	0.993	314	0.915
27	0.942	63	0.942	99	0.991	135	0.915	171	0.991	207	0.942	243	0.942	279	0.991	315	0.915
28	0.940	64	0.945	100	0.989	136	0.915	172	0.993	208	0.940	244	0.945	280	0.989	316	0.915
29	0.937	65	0.948	101	0.987	137	0.915	173	0.994	209	0.937	245	0.948	281	0.987	317	0.915
30	0.935	66	0.951	102	0.985	138	0.916	174	0.996	210	0.935	246	0.951	282	0.985	318	0.916
31	0.932	67	0.954	103	0.982	139	0.917	175	0.997	211	0.932	247	0.954	283	0.982	319	0.917
32	0.930	68	0.957	104	0.980	140	0.917	176	0.998	212	0.930	248	0.957	284	0.980	320	0.917
33	0.928	69	0.960	105	0.977	141	0.918	177	0.999	213	0.928	249	0.960	285	0.977	321	0.918
34	0.926	70	0.963	106	0.974	142	0.919	178	1.000	214	0.926	250	0.963	286	0.974	322	0.919
35	0.924	71	0.966	107	0.972	143	0.921	179	1.000	215	0.924	251	0.966	287	0.972	323	0.921

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## AZIMUTH PATTERN Vertical Polarization

Proposal No. **C-70678-4**  
 Date **26-Jun-17**  
 Call Letters **WEAO**  
 Channel **24**  
 Frequency **533 MHz**  
 Antenna Type **TFU-21JTH/VP-R O4**  
 Gain **1.39 (1.43dB)**  
 Calculated  
 Circularity **+/- 2.0 dB**

Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value
0	0.460	36	0.628	72	0.512	108	0.512	144	0.628	180	0.460	216	0.628	252	0.512	288	0.512	324	0.628
1	0.460	37	0.633	73	0.506	109	0.518	145	0.623	181	0.460	217	0.633	253	0.506	289	0.518	325	0.623
2	0.460	38	0.637	74	0.501	110	0.524	146	0.618	182	0.460	218	0.637	254	0.501	290	0.524	326	0.618
3	0.461	39	0.641	75	0.495	111	0.531	147	0.612	183	0.461	219	0.641	255	0.495	291	0.531	327	0.612
4	0.462	40	0.644	76	0.491	112	0.537	148	0.606	184	0.462	220	0.644	256	0.491	292	0.537	328	0.606
5	0.463	41	0.646	77	0.486	113	0.544	149	0.600	185	0.463	221	0.646	257	0.486	293	0.544	329	0.600
6	0.465	42	0.648	78	0.482	114	0.551	150	0.593	186	0.465	222	0.648	258	0.482	294	0.551	330	0.593
7	0.467	43	0.650	79	0.478	115	0.558	151	0.586	187	0.467	223	0.650	259	0.478	295	0.558	331	0.586
8	0.469	44	0.651	80	0.475	116	0.565	152	0.579	188	0.469	224	0.651	260	0.475	296	0.565	332	0.579
9	0.472	45	0.651	81	0.472	117	0.572	153	0.572	189	0.472	225	0.651	261	0.472	297	0.572	333	0.572
10	0.475	46	0.651	82	0.469	118	0.579	154	0.565	190	0.475	226	0.651	262	0.469	298	0.579	334	0.565
11	0.478	47	0.650	83	0.467	119	0.586	155	0.558	191	0.478	227	0.650	263	0.467	299	0.586	335	0.558
12	0.482	48	0.648	84	0.465	120	0.593	156	0.551	192	0.482	228	0.648	264	0.465	300	0.593	336	0.551
13	0.486	49	0.646	85	0.463	121	0.600	157	0.544	193	0.486	229	0.646	265	0.463	301	0.600	337	0.544
14	0.491	50	0.644	86	0.462	122	0.606	158	0.537	194	0.491	230	0.644	266	0.462	302	0.606	338	0.537
15	0.495	51	0.641	87	0.461	123	0.612	159	0.531	195	0.495	231	0.641	267	0.461	303	0.612	339	0.531
16	0.501	52	0.637	88	0.460	124	0.618	160	0.524	196	0.501	232	0.637	268	0.460	304	0.618	340	0.524
17	0.506	53	0.633	89	0.460	125	0.623	161	0.518	197	0.506	233	0.633	269	0.460	305	0.623	341	0.518
18	0.512	54	0.628	90	0.460	126	0.628	162	0.512	198	0.512	234	0.628	270	0.460	306	0.628	342	0.512
19	0.518	55	0.623	91	0.460	127	0.633	163	0.506	199	0.518	235	0.623	271	0.460	307	0.633	343	0.506
20	0.524	56	0.618	92	0.460	128	0.637	164	0.501	200	0.524	236	0.618	272	0.460	308	0.637	344	0.501
21	0.531	57	0.612	93	0.461	129	0.641	165	0.495	201	0.531	237	0.612	273	0.461	309	0.641	345	0.495
22	0.537	58	0.606	94	0.462	130	0.644	166	0.491	202	0.537	238	0.606	274	0.462	310	0.644	346	0.491
23	0.544	59	0.600	95	0.463	131	0.646	167	0.486	203	0.544	239	0.600	275	0.463	311	0.646	347	0.486
24	0.551	60	0.593	96	0.465	132	0.648	168	0.482	204	0.551	240	0.593	276	0.465	312	0.648	348	0.482
25	0.558	61	0.586	97	0.467	133	0.650	169	0.478	205	0.558	241	0.586	277	0.467	313	0.650	349	0.478
26	0.565	62	0.579	98	0.469	134	0.651	170	0.475	206	0.565	242	0.579	278	0.469	314	0.651	350	0.475
27	0.572	63	0.572	99	0.472	135	0.651	171	0.472	207	0.572	243	0.572	279	0.472	315	0.651	351	0.472
28	0.579	64	0.565	100	0.475	136	0.651	172	0.469	208	0.579	244	0.565	280	0.475	316	0.651	352	0.469
29	0.586	65	0.558	101	0.478	137	0.650	173	0.467	209	0.586	245	0.558	281	0.478	317	0.650	353	0.467
30	0.593	66	0.551	102	0.482	138	0.648	174	0.465	210	0.593	246	0.551	282	0.482	318	0.648	354	0.465
31	0.600	67	0.544	103	0.486	139	0.646	175	0.463	211	0.600	247	0.544	283	0.486	319	0.646	355	0.463
32	0.606	68	0.537	104	0.491	140	0.644	176	0.462	212	0.606	248	0.537	284	0.491	320	0.644	356	0.462
33	0.612	69	0.531	105	0.495	141	0.641	177	0.461	213	0.612	249	0.531	285	0.495	321	0.641	357	0.461
34	0.618	70	0.524	106	0.501	142	0.637	178	0.460	214	0.618	250	0.524	286	0.501	322	0.637	358	0.460
35	0.623	71	0.518	107	0.506	143	0.633	179	0.460	215	0.623	251	0.518	287	0.506	323	0.633	359	0.460

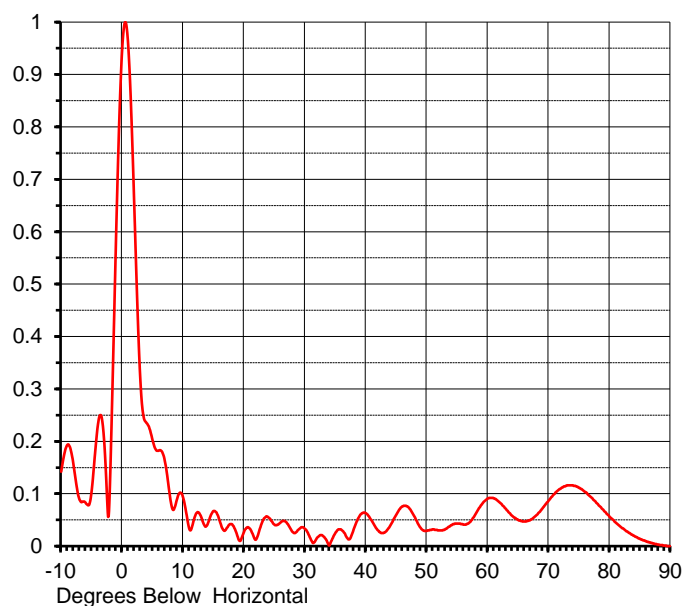
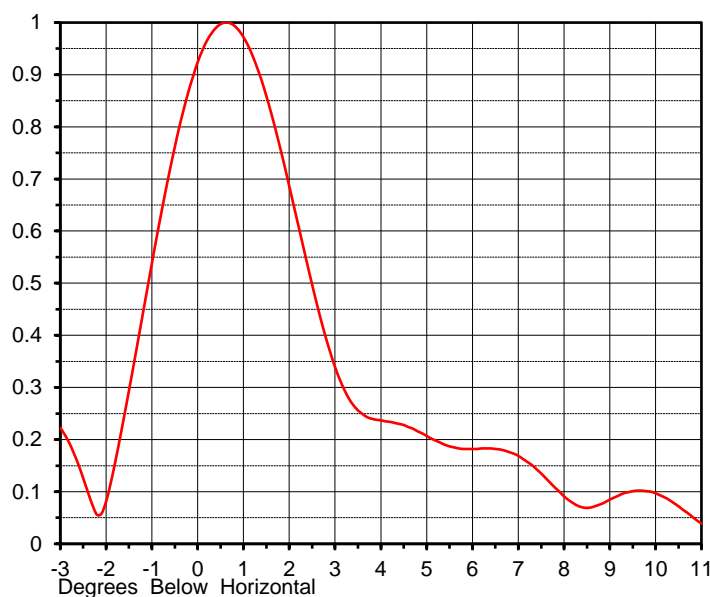
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## ELEVATION PATTERN

Proposal No. **C-70678-4**  
 Date **26-Jun-17**  
 Call Letters **WEAO**  
 Channel **24**  
 Frequency **533 MHz**  
 Antenna Type **TFU-21JTH/VP-R O4**

RMS Directivity at Main Lobe **19.0 ( 12.79 dB )**  
 RMS Directivity at Horizontal **17.0 ( 12.30 dB )**  
**Calculated**

Beam Tilt **0.50 deg**  
 Pattern Number **21J190050**



Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.142	10.0	0.093	30.0	0.033	50.0	0.029	70.0	0.087
-9.0	0.193	11.0	0.034	31.0	0.012	51.0	0.032	71.0	0.100
-8.0	0.157	12.0	0.058	32.0	0.016	52.0	0.030	72.0	0.110
-7.0	0.089	13.0	0.055	33.0	0.019	53.0	0.032	73.0	0.116
-6.0	0.083	14.0	0.041	34.0	0.001	54.0	0.040	74.0	0.116
-5.0	0.105	15.0	0.067	35.0	0.025	55.0	0.043	75.0	0.111
-4.0	0.229	16.0	0.049	36.0	0.031	56.0	0.041	76.0	0.103
-3.0	0.209	17.0	0.031	37.0	0.015	57.0	0.045	77.0	0.093
-2.0	0.116	18.0	0.042	38.0	0.032	58.0	0.061	78.0	0.081
-1.0	0.586	19.0	0.017	39.0	0.058	59.0	0.079	79.0	0.069
0.0	0.946	20.0	0.027	40.0	0.063	60.0	0.091	80.0	0.056
1.0	0.956	21.0	0.033	41.0	0.048	61.0	0.091	81.0	0.045
2.0	0.648	22.0	0.013	42.0	0.030	62.0	0.083	82.0	0.035
3.0	0.316	23.0	0.046	43.0	0.026	63.0	0.071	83.0	0.027
4.0	0.235	24.0	0.055	44.0	0.039	64.0	0.058	84.0	0.020
5.0	0.202	25.0	0.041	45.0	0.060	65.0	0.050	85.0	0.014
6.0	0.182	26.0	0.045	46.0	0.076	66.0	0.047	86.0	0.009
7.0	0.163	27.0	0.045	47.0	0.074	67.0	0.050	87.0	0.006
8.0	0.084	28.0	0.027	48.0	0.056	68.0	0.059	88.0	0.003
9.0	0.089	29.0	0.032	49.0	0.035	69.0	0.072	89.0	0.001
								90.0	0.000

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***FutureFill** refers to broadband panels or limited bandwidth slotted coaxial antennas that can be modified in the field to provide the flexibility to customize the null structure at a future date.*

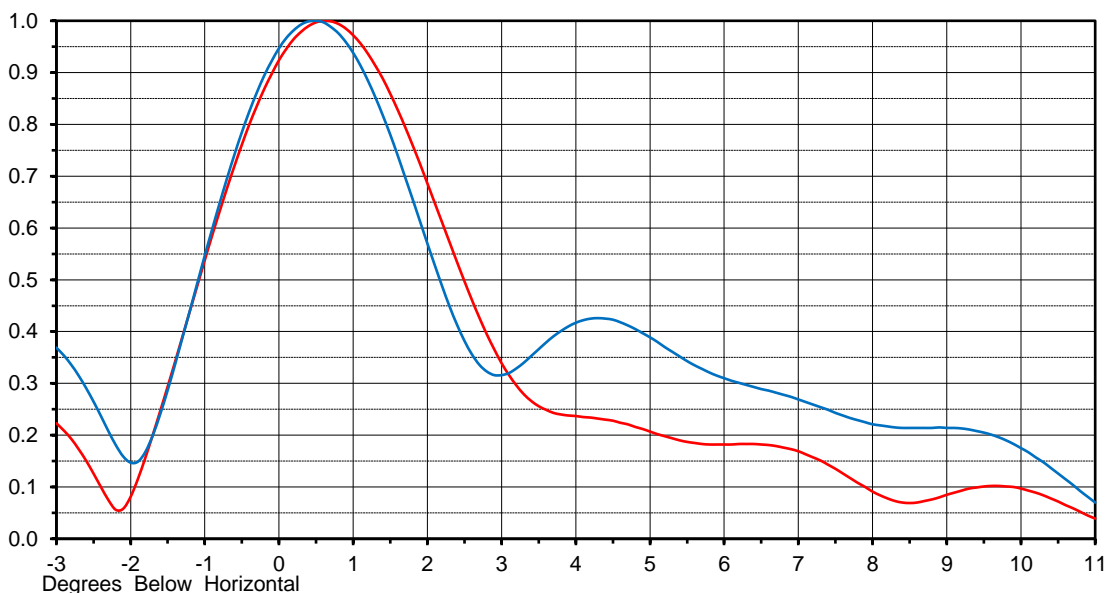
## FutureFill OVERLAY

Proposal No. **C-70678-4**  
 Date **26-Jun-17**  
 Call Letters **WEAO**  
 Channel **24**  
 Frequency **533 MHz**  
 Antenna Type **TFU-21JTH/VP-R O4**

RMS Directivity 19.0 **(12.79dB)**  
 RMS Directivity 12.0 **(10.79dB)**  
 Calculated

Beam Tilt 0.50  
 Beam Tilt 0.50

Pattern No. 21J190050 **Red**  
 Pattern No. 21J190050-FF **Blue**



Tabulations for 21J190050-FF

Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.058	10.0	0.175	30.0	0.236	50.0	0.084	70.0	0.058
-9.0	0.064	11.0	0.070	31.0	0.202	51.0	0.089	71.0	0.078
-8.0	0.038	12.0	0.032	32.0	0.167	52.0	0.092	72.0	0.094
-7.0	0.109	13.0	0.016	33.0	0.158	53.0	0.100	73.0	0.105
-6.0	0.148	14.0	0.068	34.0	0.165	54.0	0.112	74.0	0.110
-5.0	0.157	15.0	0.126	35.0	0.167	55.0	0.119	75.0	0.109
-4.0	0.338	16.0	0.113	36.0	0.149	56.0	0.119	76.0	0.103
-3.0	0.369	17.0	0.077	37.0	0.117	57.0	0.113	77.0	0.093
-2.0	0.147	18.0	0.093	38.0	0.105	58.0	0.109	78.0	0.082
-1.0	0.547	19.0	0.129	39.0	0.121	59.0	0.109	79.0	0.070
0.0	0.947	20.0	0.165	40.0	0.126	60.0	0.107	80.0	0.058
1.0	0.938	21.0	0.183	41.0	0.111	61.0	0.099	81.0	0.046
2.0	0.570	22.0	0.202	42.0	0.092	62.0	0.086	82.0	0.036
3.0	0.316	23.0	0.243	43.0	0.083	63.0	0.073	83.0	0.027
4.0	0.417	24.0	0.268	44.0	0.089	64.0	0.064	84.0	0.020
5.0	0.389	25.0	0.253	45.0	0.106	65.0	0.057	85.0	0.014
6.0	0.310	26.0	0.220	46.0	0.119	66.0	0.049	86.0	0.009
7.0	0.269	27.0	0.200	47.0	0.115	67.0	0.039	87.0	0.006
8.0	0.221	28.0	0.213	48.0	0.098	68.0	0.031	88.0	0.003
9.0	0.214	29.0	0.238	49.0	0.084	69.0	0.039	89.0	0.001
								90.0	0.000

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## MECHANICAL SPECIFICATIONS

Proposal No. **C-70678-4**  
 Date **26-Jun-17**  
 Call Letters **WEAO**  
 Channel **24**  
 Frequency **533 MHz**  
 Antenna Type **TFU-21JTH/VP-R 04**

### Preliminary Specifications

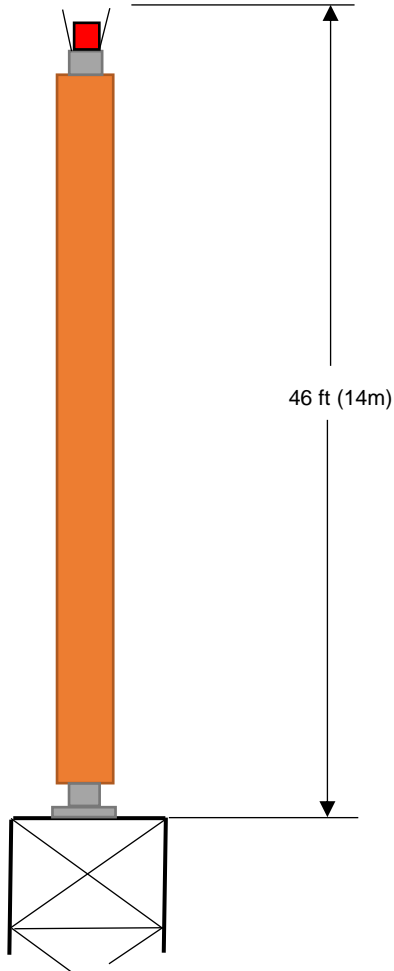
#### Top Mounted

##### With ice TIA-222-G

Height AGL(z) 871 ft (265.5 m)  
 Basic Wind Speed 90 m/h (144.8 km/h)

Structure Class II  
 Exposure Category C  
 Topography Category 1

Design Ice 0.75 in  $t_{iz} = 2.08$  in  
 Wind Speed w/Ice 40 m/h (64.4 km/h)



#### Mechanical Specifications

		without ice	with ice
Height with Lightning Protector	H4	46 ft (14m)	
Height less Lightning Protector	H2	43 ft (13.1m)	
Height of Center of Radiation	H3	21.5 ft (6.6m)	
Effective Projected Area	(EPA) <sub>S</sub>	45.8 ft² (4.3m²)	123.2 ft² (11.4m²)
Moment Arm	D1	23.2 ft (7.1m)	24.1 ft (7.3m)

Weight W 6500 lb (2.9t) 9500 lb (4.3t)

Antenna designed in accordance with AISC specifications for design of structural steel as prescribed by TIA-222-G

Prepared by: NJS

Date: 8-May-17

ME: *SPJC*

EE:

Rev. No.4 by: SPJC

Date: 26-Jun-17

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## Summary

Proposal No.	<b>C-70678-4</b>
Date	<b>26-Jun-17</b>
Call Letters	<b>WEAO</b>
Channel	<b>24</b>
Frequency	<b>533 MHz</b>
Antenna Type	<b>TFU-21JTH/VP-R O4</b>

## Antenna

	Hpol	Vpol
ERP:	<b>150 kW ( 21.76 dBk )</b>	<b>50.0 kW ( 16.99 dBk )</b>
RMS Gain*	14.25 ( 11.54 dB )	4.75 ( 6.76 dB )

<b>Antenna Input Power</b>	<b>10.5 kW ( 10.22 dBk )</b>
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## Transmission Line

Type:	<b>Rigid</b>	Attenuation:	<b>( 1.10 dB )</b>
Size:	<b>6-1/8"</b>	Efficiency:	<b>77.7%</b>
Impedance:	<b>75 Ohm</b>		
Length:	<b>980 ft</b>	<b>298.7 m</b>	

## Transmitter Output

<b>13.5 kW ( 11.32 dBk )</b>
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Transmitter filter losses not included

\* Directivity and Gain are with respect to half wave dipole. The gain includes feed system losses

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