



Antenna Model: **TFU-16WB-R C160 OS**

Proposal Number: **C-70077-1**
Date: **8-Aug-18**
Customer: **TEGNA**
Location: **Charlotte, NC**

Electrical Specifications

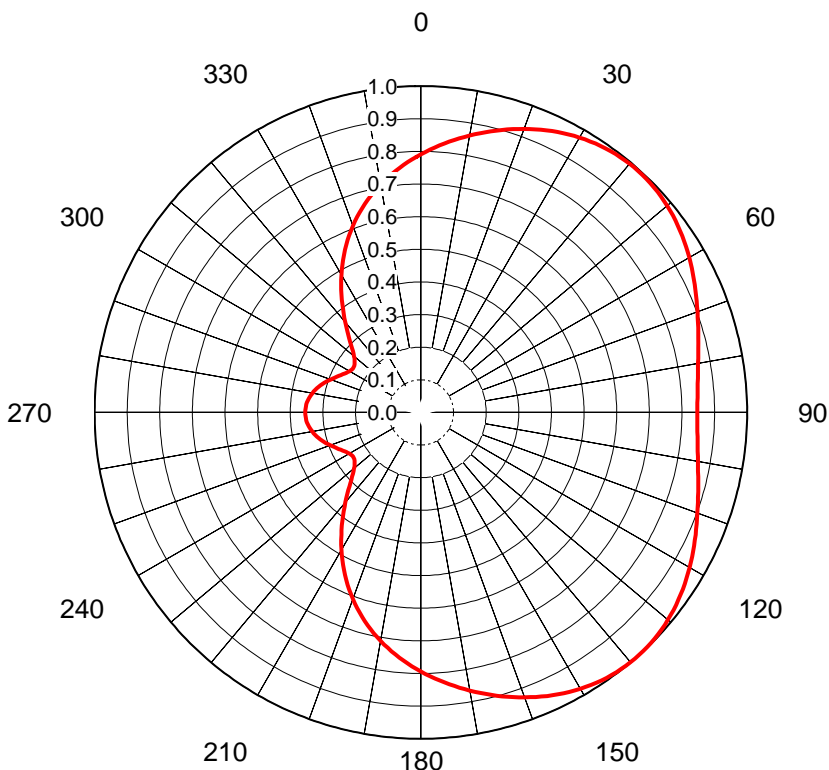
Polarization: **Horizontal**
Azimuth Pattern: **Directional**
Antenna Input: **6-1/8"** **50 Ohm** **EIA/DCA**
VSWR: **Channel** **1.10 : 1** **Band** **1.10 : 1**
Bandwidth: **470 - 698 MHz**
Rated Input Power: **40 kW** **(16.02 dBk)** **Maximum combined average power**

Mechanical Specifications

Mounting: **Side Mounted**
Environmental Protection: **Full Radome**
Height: **28.9 ft (8.8m)**
Weight: **1300 lb (0.6t)** **Excludes Mounts**
Effective Projected Area: **42.5 ft² (3.9m²)** **TIA-222-G** **Basic Wind Speed: 90 m/h (144.8 km/h)**

Channel Specifications

	Call	CH	Freq	Hpol ERP	TPO	Peak Main Lobe Hpol Gain	Peak at Horizontal Hpol Gain
1	WCNC	22	521 MHz	791 kW (28.98 dBk)	48.9 kW (16.90 dBk)	26.57 (14.24dB)	20.86 (13.19dB)
2	WCNC	24	533 MHz	990 kW (29.96 dBk)	58.9 kW (17.70 dBk)	27.80 (14.44dB)	



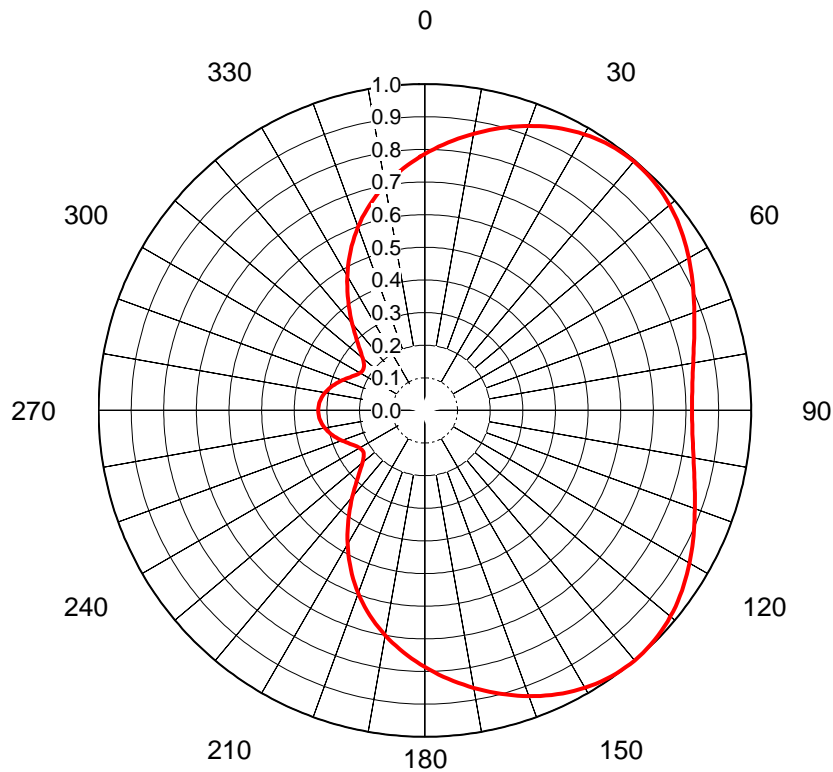
AZIMUTH PATTERN Horizontal Polarization

In Free Space

Proposal No. **C-70077-1**
 Date **8-Aug-18**
 Call Letters **WCNC**
 Channel **22**
 Frequency **521 MHz**
 Antenna Type **TFU-16WB-R C160 OS**
 Gain **1.87 (2.72dB)**
 Calculated

Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value
0	0.791	36	0.990	72	0.893	108	0.893	144	0.995	180	0.794	216	0.409	252	0.305	288	0.305	324	0.409
1	0.798	37	0.991	73	0.889	109	0.897	145	0.993	181	0.786	217	0.396	253	0.310	289	0.300	325	0.422
2	0.806	38	0.993	74	0.884	110	0.902	146	0.990	182	0.778	218	0.384	254	0.314	290	0.295	326	0.435
3	0.813	39	0.994	75	0.880	111	0.907	147	0.988	183	0.770	219	0.372	255	0.319	291	0.290	327	0.448
4	0.820	40	0.995	76	0.876	112	0.912	148	0.985	184	0.762	220	0.360	256	0.323	292	0.285	328	0.461
5	0.827	41	0.995	77	0.873	113	0.917	149	0.981	185	0.754	221	0.348	257	0.327	293	0.280	329	0.474
6	0.834	42	0.996	78	0.869	114	0.922	150	0.978	186	0.746	222	0.337	258	0.331	294	0.275	330	0.487
7	0.841	43	0.995	79	0.866	115	0.927	151	0.974	187	0.737	223	0.326	259	0.335	295	0.271	331	0.500
8	0.848	44	0.995	80	0.863	116	0.931	152	0.970	188	0.729	224	0.316	260	0.338	296	0.266	332	0.512
9	0.855	45	0.994	81	0.860	117	0.936	153	0.965	189	0.720	225	0.306	261	0.341	297	0.262	333	0.525
10	0.862	46	0.993	82	0.857	118	0.941	154	0.961	190	0.711	226	0.297	262	0.344	298	0.259	334	0.538
11	0.868	47	0.992	83	0.855	119	0.946	155	0.956	191	0.702	227	0.288	263	0.346	299	0.255	335	0.550
12	0.875	48	0.990	84	0.853	120	0.951	156	0.951	192	0.692	228	0.280	264	0.348	300	0.253	336	0.562
13	0.881	49	0.988	85	0.851	121	0.955	157	0.946	193	0.683	229	0.273	265	0.350	301	0.250	337	0.574
14	0.888	50	0.986	86	0.850	122	0.960	158	0.941	194	0.673	230	0.267	266	0.352	302	0.249	338	0.586
15	0.894	51	0.983	87	0.849	123	0.964	159	0.935	195	0.663	231	0.262	267	0.353	303	0.248	339	0.597
16	0.901	52	0.980	88	0.848	124	0.968	160	0.929	196	0.652	232	0.257	268	0.354	304	0.248	340	0.609
17	0.907	53	0.977	89	0.848	125	0.972	161	0.923	197	0.642	233	0.254	269	0.354	305	0.249	341	0.620
18	0.913	54	0.974	90	0.847	126	0.976	162	0.917	198	0.631	234	0.251	270	0.354	306	0.251	342	0.631
19	0.919	55	0.970	91	0.848	127	0.980	163	0.911	199	0.620	235	0.249	271	0.354	307	0.254	343	0.641
20	0.925	56	0.966	92	0.848	128	0.983	164	0.905	200	0.609	236	0.249	272	0.354	308	0.257	344	0.652
21	0.930	57	0.962	93	0.849	129	0.986	165	0.899	201	0.597	237	0.248	273	0.353	309	0.262	345	0.662
22	0.936	58	0.958	94	0.850	130	0.989	166	0.892	202	0.586	238	0.249	274	0.352	310	0.267	346	0.672
23	0.941	59	0.954	95	0.851	131	0.991	167	0.886	203	0.574	239	0.251	275	0.350	311	0.273	347	0.681
24	0.946	60	0.950	96	0.853	132	0.993	168	0.879	204	0.562	240	0.253	276	0.348	312	0.281	348	0.691
25	0.951	61	0.945	97	0.855	133	0.995	169	0.872	205	0.550	241	0.256	277	0.346	313	0.288	349	0.700
26	0.956	62	0.940	98	0.857	134	0.997	170	0.866	206	0.537	242	0.259	278	0.344	314	0.297	350	0.709
27	0.960	63	0.936	99	0.860	135	0.998	171	0.859	207	0.525	243	0.262	279	0.341	315	0.306	351	0.718
28	0.965	64	0.931	100	0.862	136	0.999	172	0.852	208	0.512	244	0.266	280	0.338	316	0.316	352	0.727
29	0.969	65	0.926	101	0.865	137	1.000	173	0.845	209	0.499	245	0.271	281	0.335	317	0.326	353	0.736
30	0.973	66	0.921	102	0.869	138	1.000	174	0.838	210	0.486	246	0.275	282	0.331	318	0.337	354	0.744
31	0.976	67	0.916	103	0.872	139	1.000	175	0.831	211	0.474	247	0.280	283	0.327	319	0.348	355	0.752
32	0.979	68	0.912	104	0.876	140	1.000	176	0.823	212	0.461	248	0.285	284	0.323	320	0.360	356	0.760
33	0.983	69	0.907	105	0.880	141	0.999	177	0.816	213	0.448	249	0.290	285	0.319	321	0.372	357	0.768
34	0.985	70	0.902	106	0.884	142	0.998	178	0.809	214	0.435	250	0.295	286	0.314	322	0.384	358	0.776
35	0.988	71	0.898	107	0.888	143	0.996	179	0.801	215	0.422	251	0.300	287	0.310	323	0.397	359	0.783

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AZIMUTH PATTERN Horizontal Polarization

In Free Space

Proposal No. **C-70077-1**
 Date **8-Aug-18**
 Call Letters **WCNC**
 Channel **24**
 Frequency **533 MHz**
 Antenna Type **TFU-16WB-R C160 OS**
 Gain **1.92 (2.84dB)**
 Calculated

Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value	Deg	Value
0	0.786	36	0.993	72	0.869	108	0.870	144	0.997	180	0.786	216	0.396	252	0.279	288	0.279	324	0.397
1	0.794	37	0.994	73	0.864	109	0.875	145	0.995	181	0.778	217	0.383	253	0.284	289	0.274	325	0.410
2	0.802	38	0.995	74	0.859	110	0.881	146	0.993	182	0.770	218	0.370	254	0.288	290	0.270	326	0.423
3	0.809	39	0.996	75	0.854	111	0.886	147	0.991	183	0.762	219	0.358	255	0.293	291	0.265	327	0.436
4	0.817	40	0.996	76	0.850	112	0.891	148	0.988	184	0.753	220	0.346	256	0.297	292	0.260	328	0.449
5	0.824	41	0.996	77	0.846	113	0.897	149	0.985	185	0.745	221	0.334	257	0.301	293	0.255	329	0.462
6	0.832	42	0.996	78	0.842	114	0.903	150	0.981	186	0.736	222	0.322	258	0.304	294	0.251	330	0.475
7	0.839	43	0.995	79	0.838	115	0.908	151	0.978	187	0.727	223	0.311	259	0.308	295	0.246	331	0.488
8	0.847	44	0.994	80	0.835	116	0.914	152	0.974	188	0.718	224	0.301	260	0.311	296	0.242	332	0.501
9	0.854	45	0.992	81	0.832	117	0.920	153	0.969	189	0.709	225	0.290	261	0.314	297	0.238	333	0.514
10	0.861	46	0.990	82	0.829	118	0.925	154	0.965	190	0.700	226	0.281	262	0.317	298	0.235	334	0.526
11	0.868	47	0.988	83	0.827	119	0.931	155	0.960	191	0.690	227	0.272	263	0.319	299	0.232	335	0.539
12	0.875	48	0.985	84	0.825	120	0.937	156	0.955	192	0.681	228	0.264	264	0.321	300	0.230	336	0.551
13	0.882	49	0.983	85	0.823	121	0.942	157	0.949	193	0.671	229	0.256	265	0.323	301	0.228	337	0.563
14	0.889	50	0.979	86	0.821	122	0.947	158	0.944	194	0.661	230	0.249	266	0.324	302	0.227	338	0.575
15	0.896	51	0.976	87	0.820	123	0.952	159	0.938	195	0.651	231	0.244	267	0.325	303	0.226	339	0.587
16	0.902	52	0.972	88	0.819	124	0.957	160	0.932	196	0.640	232	0.239	268	0.326	304	0.227	340	0.598
17	0.909	53	0.968	89	0.819	125	0.962	161	0.925	197	0.630	233	0.235	269	0.327	305	0.228	341	0.610
18	0.915	54	0.964	90	0.819	126	0.967	162	0.919	198	0.619	234	0.231	270	0.327	306	0.231	342	0.621
19	0.922	55	0.959	91	0.819	127	0.971	163	0.913	199	0.608	235	0.229	271	0.327	307	0.234	343	0.632
20	0.928	56	0.955	92	0.820	128	0.975	164	0.906	200	0.596	236	0.228	272	0.326	308	0.238	344	0.642
21	0.934	57	0.950	93	0.821	129	0.979	165	0.899	201	0.585	237	0.227	273	0.325	309	0.243	345	0.653
22	0.939	58	0.945	94	0.822	130	0.982	166	0.892	202	0.573	238	0.227	274	0.324	310	0.249	346	0.663
23	0.945	59	0.940	95	0.823	131	0.986	167	0.885	203	0.561	239	0.229	275	0.323	311	0.256	347	0.673
24	0.950	60	0.934	96	0.825	132	0.989	168	0.878	204	0.549	240	0.230	276	0.321	312	0.263	348	0.682
25	0.956	61	0.929	97	0.827	133	0.991	169	0.871	205	0.537	241	0.233	277	0.319	313	0.271	349	0.692
26	0.960	62	0.923	98	0.830	134	0.994	170	0.863	206	0.525	242	0.236	278	0.317	314	0.280	350	0.701
27	0.965	63	0.918	99	0.833	135	0.996	171	0.856	207	0.512	243	0.239	279	0.314	315	0.290	351	0.711
28	0.969	64	0.912	100	0.836	136	0.997	172	0.849	208	0.499	244	0.243	280	0.311	316	0.300	352	0.719
29	0.973	65	0.906	101	0.839	137	0.999	173	0.841	209	0.487	245	0.247	281	0.308	317	0.311	353	0.728
30	0.977	66	0.901	102	0.843	138	0.999	174	0.833	210	0.474	246	0.251	282	0.304	318	0.322	354	0.737
31	0.981	67	0.895	103	0.847	139	1.000	175	0.826	211	0.461	247	0.256	283	0.301	319	0.334	355	0.745
32	0.984	68	0.890	104	0.851	140	1.000	176	0.818	212	0.448	248	0.260	284	0.297	320	0.346	356	0.754
33	0.987	69	0.884	105	0.856	141	1.000	177	0.810	213	0.435	249	0.265	285	0.293	321	0.358	357	0.762
34	0.989	70	0.879	106	0.860	142	0.999	178	0.802	214	0.422	250	0.270	286	0.288	322	0.371	358	0.770
35	0.991	71	0.874	107	0.865	143	0.998	179	0.794	215	0.409	251	0.275	287	0.284	323	0.384	359	0.778

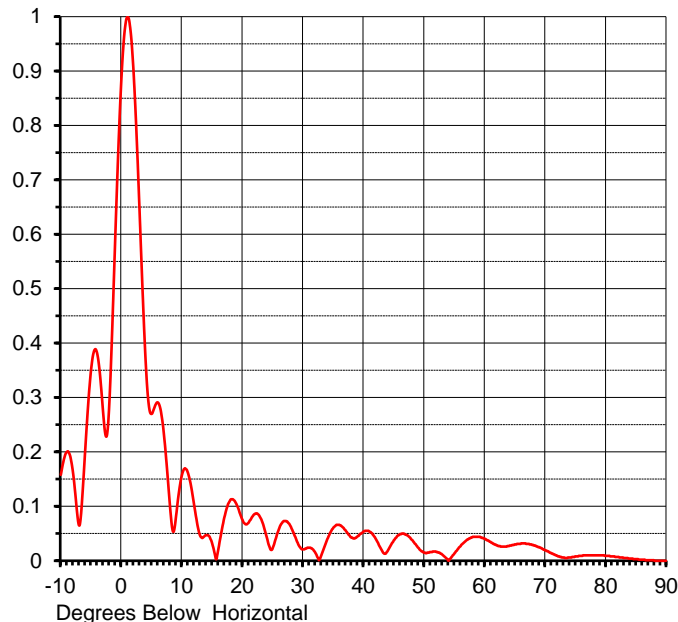
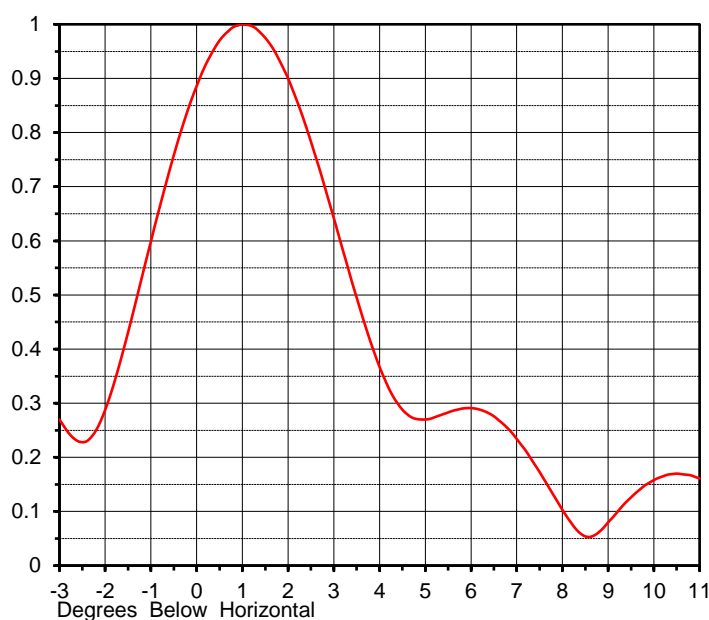
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ELEVATION PATTERN

Proposal No. **C-70077-1**
 Date **8-Aug-18**
 Call Letters **WCNC**
 Channel **22**
 Frequency **521 MHz**
 Antenna Type **TFU-16WB-R C160 OS**

RMS Directivity at Main Lobe **14.2 (11.52 dB)**
 RMS Directivity at Horizontal **11.1 (10.45 dB)**
Calculated

Beam Tilt **1.00 deg**
 Pattern Number **16W142100**



Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.158	10.0	0.158	30.0	0.021	50.0	0.015	70.0	0.019
-9.0	0.200	11.0	0.161	31.0	0.024	51.0	0.016	71.0	0.014
-8.0	0.163	12.0	0.103	32.0	0.015	52.0	0.016	72.0	0.009
-7.0	0.065	13.0	0.046	33.0	0.010	53.0	0.011	73.0	0.006
-6.0	0.199	14.0	0.047	34.0	0.040	54.0	0.000	74.0	0.006
-5.0	0.352	15.0	0.031	35.0	0.061	55.0	0.014	75.0	0.008
-4.0	0.381	16.0	0.021	36.0	0.066	56.0	0.027	76.0	0.009
-3.0	0.270	17.0	0.080	37.0	0.056	57.0	0.038	77.0	0.010
-2.0	0.288	18.0	0.112	38.0	0.043	58.0	0.044	78.0	0.010
-1.0	0.599	19.0	0.104	39.0	0.045	59.0	0.044	79.0	0.010
0.0	0.886	20.0	0.075	40.0	0.054	60.0	0.040	80.0	0.009
1.0	1.000	21.0	0.070	41.0	0.053	61.0	0.034	81.0	0.008
2.0	0.900	22.0	0.086	42.0	0.040	62.0	0.028	82.0	0.007
3.0	0.642	23.0	0.078	43.0	0.019	63.0	0.026	83.0	0.005
4.0	0.367	24.0	0.043	44.0	0.019	64.0	0.027	84.0	0.004
5.0	0.270	25.0	0.024	45.0	0.038	65.0	0.030	85.0	0.003
6.0	0.291	26.0	0.058	46.0	0.049	66.0	0.032	86.0	0.002
7.0	0.234	27.0	0.073	47.0	0.048	67.0	0.031	87.0	0.001
8.0	0.103	28.0	0.062	48.0	0.038	68.0	0.029	88.0	0.000
9.0	0.080	29.0	0.035	49.0	0.024	69.0	0.025	89.0	0.000
								90.0	0.000

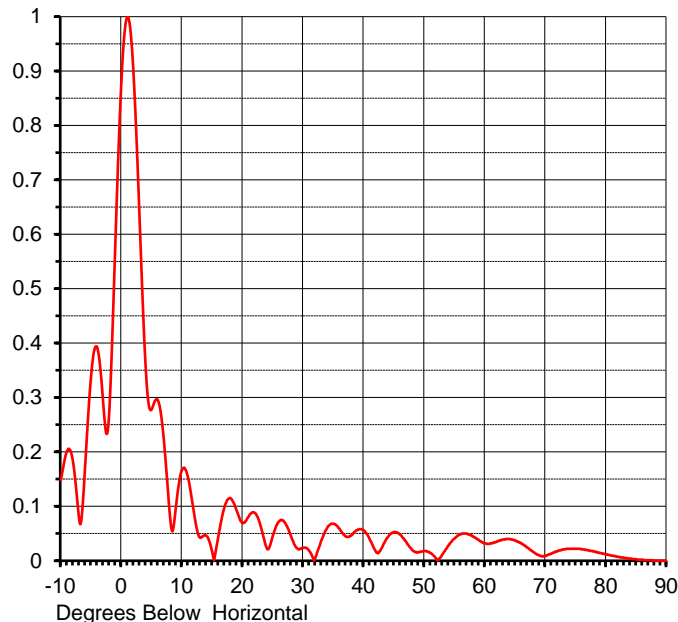
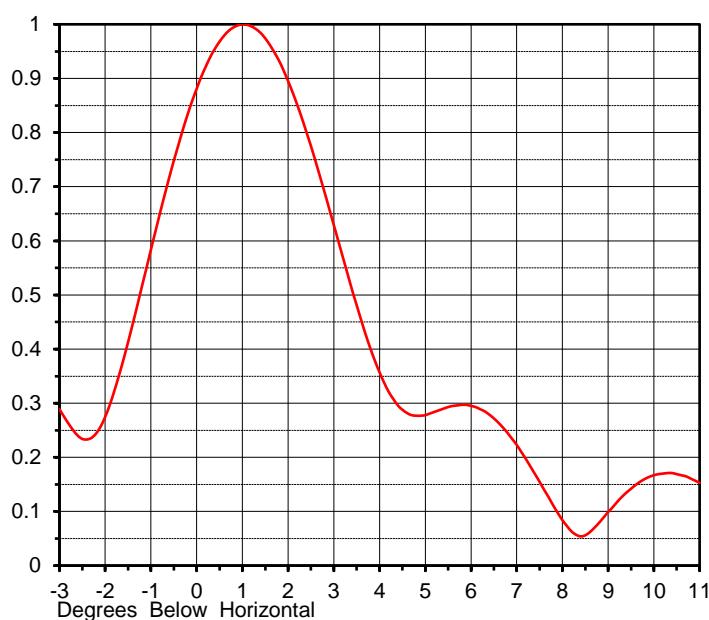
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ELEVATION PATTERN

Proposal No. **C-70077-1**
 Date **8-Aug-18**
 Call Letters **WCNC**
 Channel **24**
 Frequency **533 MHz**
 Antenna Type **TFU-16WB-R C160 OS**

RMS Directivity at Main Lobe **14.5 (11.60 dB)**
 RMS Directivity at Horizontal **11.2 (10.49 dB)**
Calculated

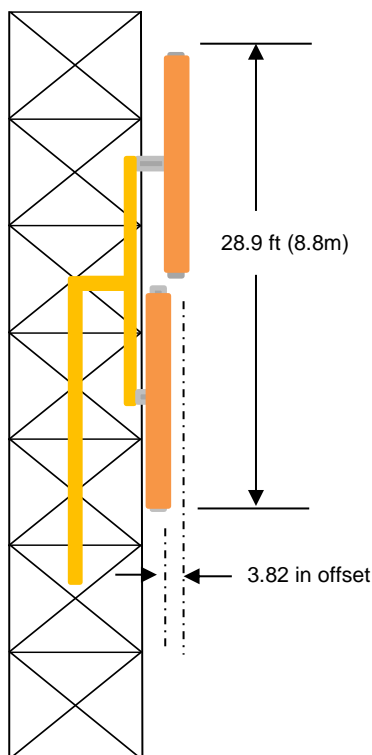
Beam Tilt **1.00 deg**
 Pattern Number **16W144100**



Angle	Field	Angle	Field	Angle	Field	Angle	Field	Angle	Field
-10.0	0.148	10.0	0.167	30.0	0.024	50.0	0.018	70.0	0.009
-9.0	0.201	11.0	0.153	31.0	0.018	51.0	0.014	71.0	0.013
-8.0	0.183	12.0	0.087	32.0	0.005	52.0	0.004	72.0	0.018
-7.0	0.079	13.0	0.043	33.0	0.037	53.0	0.012	73.0	0.021
-6.0	0.172	14.0	0.046	34.0	0.061	54.0	0.028	74.0	0.022
-5.0	0.340	15.0	0.016	35.0	0.068	55.0	0.041	75.0	0.022
-4.0	0.392	16.0	0.045	36.0	0.059	56.0	0.049	76.0	0.021
-3.0	0.289	17.0	0.098	37.0	0.045	57.0	0.050	77.0	0.019
-2.0	0.275	18.0	0.115	38.0	0.047	58.0	0.045	78.0	0.017
-1.0	0.584	19.0	0.093	39.0	0.057	59.0	0.038	79.0	0.014
0.0	0.881	20.0	0.070	40.0	0.056	60.0	0.032	80.0	0.012
1.0	1.000	21.0	0.081	41.0	0.039	61.0	0.032	81.0	0.009
2.0	0.895	22.0	0.088	42.0	0.017	62.0	0.035	82.0	0.007
3.0	0.629	23.0	0.063	43.0	0.024	63.0	0.039	83.0	0.005
4.0	0.357	24.0	0.023	44.0	0.044	64.0	0.040	84.0	0.004
5.0	0.278	25.0	0.046	45.0	0.052	65.0	0.037	85.0	0.003
6.0	0.295	26.0	0.072	46.0	0.048	66.0	0.032	86.0	0.002
7.0	0.223	27.0	0.070	47.0	0.035	67.0	0.024	87.0	0.001
8.0	0.084	28.0	0.045	48.0	0.020	68.0	0.016	88.0	0.000
9.0	0.099	29.0	0.023	49.0	0.016	69.0	0.010	89.0	0.000
								90.0	0.000

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MECHANICAL SPECIFICATIONS



Proposal No. **C-70077-1**
 Date **8-Aug-18**
 Call Letters **WCNC**
 Channel **22**
 Frequency **521 MHz**
 Antenna Type **TFU-16WB-R C160 OS**

Preliminary Specifications

Side Mounted

With ice TIA-222-G

Height AGL(z) 1800 ft (548.6 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 $t_{iz} = 2.10$ in
 Wind Speed w/Ice 30 m/h (48.3 km/h)

Mechanical Specifications

		without ice	with ice	
Height	H2	28.9 ft (8.8m)		
Height of Center of Radiation	H3	ft (m)		
Effective Projected Area	(EPA) _A	42.5 ft ² (3.9m ²)	85.8 ft ² (8m ²)	Mounts Excluded
Weight	W	1300 lb (0.6t)	2900 lb (1.3t)	Mounts Excluded

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

Prepared by: JBC

Date: 8-Aug-18

ME:

EE:

Rev. No.1 by: JBC

Date: 8-Aug-18

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Summary

Proposal No.	C-70077-1
Date	8-Aug-18
Call Letters	WCNC
Channel	22
Frequency	521 MHz
Antenna Type	TFU-16WB-R C160 OS

Antenna

		Hpol
ERP:	791 kW	(28.98 dBk)
Peak Gain*	26.57	(14.24 dB)

Antenna Input Power	29.8 kW	(14.74 dBk)
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Transmission Line

Type:	Rigid	Attenuation:	(2.16 dB)
Size:	6-1/8"	Efficiency:	60.8%
Impedance:	75 Ohm		
Length:	1950 ft	594.4 m	

Transmitter Output

48.9 kW	(16.90 dBk)
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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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Summary

Proposal No.	C-70077-1
Date	8-Aug-18
Call Letters	WCNC
Channel	24
Frequency	533 MHz
Antenna Type	TFU-16WB-R C160 OS

Antenna

		Hpol
ERP:	990 kW	(29.96 dBk)
Peak Gain*	27.80	(14.44 dB)

Antenna Input Power	35.6 kW	(15.52 dBk)
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Transmission Line

Type:	Rigid	Attenuation:	(2.19 dB)
Size:	6-1/8"	Efficiency:	60.5%
Impedance:	75 Ohm		
Length:	1950 ft	594.4 m	

Transmitter Output

58.9 kW	(17.70 dBk)
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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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