APPENDIX A1: Complex Weights for Single Central (4th) Element Failure Recovery In 1×8 Beamforming Cylindrical (r=20cm) Array with Element Pattern Imported from HFSS

Case: Broadside radiation pattern with single null (-40°) recovery for single central (4th) element failure				Case: Broadside radiation pattern with symmetric nulls (±40°) recovery for single central (4th) element failure				Case: Scanned radiation pattern with single null (-40°) recovery for single central (4th) element failure			
Original		Corrected		Original		Corrected		Original		Corrected	
Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)
0.3209	82.0601	0.4164	68.9273	0.1495	259.8954	0.4189	80.4371	0.1551	70.9269	0.2481	110.1518
0.5685	34.8173	0.0090	321.6316	0.4318	232.0371	0.0384	284.3521	0.4328	313.7359	0.4938	314.0595
0.9110	17.3687	1.0000	16.4851	0.7885	211.3192	1.0000	31.2026	0.7398	200.6130	0.4979	162.6958
1.0000	1.4282	0	0	1.0000	199.1787	0	0	0.9998	101.6538	0	0
1.0000	0.6623	0.9821	3.4538	1.0000	197.1789	0.9809	21.7142	1.0000	7.8274	0.6699	76.2135
0.7837	12.4414	0.0869	154.8162	0.8454	211.0376	0.1071	125.5280	0.7005	280.5154	1.0000	321.2790
0.4399	38.5947	0.4233	30.1375	0.4612	227.9965	0.4171	51.9763	0.2618	213.5235	0.7147	220.7237
0.2186	59.6643	0.0524	230.5132	0.2204	262.7103	0.0628	173.7307	0.0438	131.5239	0.2582	144.1001

Case: Scanned radiation pattern with null steering recovery (-40° to 0°) for single central (4th) element failure									
Null at 0°		Null at -10°		Null at -20°		Null at -30°		Null at -40°	
Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)
0.1954	62.6243	0.1916	293.2993	0.1960	355.2052	0.2391	246.1018	0.1163	59.1519
0.4388	251.9835	0.4274	130.3164	0.4317	192.3641	0.5065	88.0297	0.2823	268.1035
0.4541	95.0485	0.4157	336.5238	0.4243	34.1421	0.4836	291.5742	0.3226	113.7693
0	0	0	0	0	0	0	0	0	0
0.6369	357.5902	0.6383	239.5487	0.6435	301.1190	0.6633	200.6097	0.5918	23.3280
1.0000	231.8366	1.0000	116.8211	1.0000	176.0396	1.0000	77.3777	1.0000	260.3466
0.7330	120.5190	0.7253	6.5136	0.7530	64.7923	0.6954	327.5152	0.8283	152.3403
0.2514	27.5386	0.2574	276.4879	0.2779	329.8515	0.2329	236.7424	0.3537	58.2539

APPENDIX A2: Complex Weights for Double Adjacent Central Elements Failure Recovery In 1×8, 1×16 Beamforming Cylindrical (r=20cm) Arrays with Element Pattern of cos(theta)

1×8 cylindrical array with 4th and 5th failed elements		1×16 cylindrical array with 8th and 9th failed elements		1×32 cylindrical array with 16th and 17th failed elements	
Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)	Amplitudes (V)	Phases (°)
				0.0196	288.6762
				0.1194	131.1669
		0.0550	179.1901	0.1042	185.8294
		0.3268	351.4142	0.1941	160.8392
		0.1248	237.3884	0.0583	274.8644
		0.1807	357.4692	0.0509	3.4585
1.0000	144.6313	1.0000	151.7710	0.2396	110.5619
0.4208	288.6813	0.6253	300.1897	0.0782	32.4757
0.9273	91.7499	1.0000	87.9819	0.1245	261.9670
0	0	0	0	0.2727	171.7283
0	0	0	0	0.2031	74.5445
0.9252	91.9171	1.0000	72.3838	0.2168	151.2998
0.4218	288.3541	0.7631	229.9950	1.0000	327.3622
1.0000	144.8896	1.0000	92.0202	0.6655	110.7499
		1.0000	258.4519	1.0000	270.6965
		0.4529	111.3475	0	0
		0.5371	332.1957	0	0
		0.3035	143.9855	0.8184	263.5322
				0.3403	72.7760
				0.3988	298.9904

0.4647	42.6418
0.2655	245.3728
0.3702	143.0869
0.0878	288.0719
0.1350	37.5784
0.0268	81.5806
0.0343	199.6863
0.0397	346.3823
0.0706	128.0431
0.0627	6.9606
0.0310	356.9435
0.0241	298.8945

APPENDIX A3: Effect of Array Curvatures (r= 50cm, 20cm, 15cm, 10cm, 5cm) on Symmetric Nulls Recovery Under Single Central (4th) Element Failure in a 1×8 Arrays with Element Pattern of cos(theta)

Original		R=50cm		R=20cm		R=15cm		R=10cm		R=5cm	
Amplitudes (V)	**Phases (°)**	**Amplitudes (V)**	**Phases (°)**	**Amplitudes (V)**	**Phases (°)**	**Amplitudes (V)**	**Phases (°)**	**Amplitudes (V)**	**Phases (°)**	**Amplitudes (V)**	**Phases (°)**
0.3459	28.2892	0.4310	27.1870	0.4175	88.6008	0.3216	93.8253	0.3914	151.1366	0.2399	264.3755
0.5460	13.3846	0.0748	209.3150	0.0126	343.8459	0.0734	200.6109	0.1635	252.4065	0.1965	345.6259
0.9522	5.2592	1.0000	4.8393	0.9998	19.2982	0.9047	19.6961	0.9658	32.3672	0.6828	59.1492
1.0000	359.8634	0	0	0	0	0	0	0	0	0	0
0.9717	0.5789	1.0000	0.0034	0.9965	358.7803	1.0000	3.4844	1.0000	2.0322	1.0000	357.7960
0.7427	5.4795	0.1663	19.6174	0.0830	109.4727	0.1072	31.6861	0.2270	67.9388	0.5709	151.7990
0.3738	15.0452	0.4285	13.5930	0.4385	21.6494	0.4790	49.1632	0.4189	62.5909	0.7742	92.1766
0.1311	31.8321	0.1569	43.4378	0.0889	157.6835	0.0892	104.8490	0.2162	170.0241	0.6207	337.8059