

LIST OF FIGURES

Fig. 1-1:	General configuration showing distribution of antenna elements at the aperture of TLA array.	3
Fig. 1-2:	General configuration showing distribution of antenna elements at the aperture of TPA array.	4
Fig. 1-3:	General configuration showing distribution of antenna elements at the aperture of NUSLA array.	5
Fig. 1-4:	General configuration showing distribution of antenna elements at the aperture of NUSPA array.	5
Fig. 1-5:	General configuration showing distribution of antenna elements at the aperture of MFA array sharing the same physical aperture.	7
Fig. 2-1:	General configuration of a linear array with $2N$ antenna elements.	35
Fig. 2-2:	Optimal distribution of half of the ‘ON’ and ‘OFF’ elements at the aperture of 100-element TLA array.	40
Fig. 2-3:	Radiation pattern of the proposed 100-element TLA array.	40
Fig. 2-4:	Radiation patterns of the proposed 100-element TLA array in the angular sector ($\theta = 0^0-10^0$).	40
Fig. 2-5:	Variations of fitness value i.e. PSLI overall best and averaged over 30 trials with number of iterations in the optimization of proposed 100-element TLA array	43
Fig. 2-6:	Optimal distribution of half of the ‘ON’ and ‘OFF’ elements at the aperture of 100-elements TLA array.	43
Fig. 2-7:	Comparison of radiation patterns of the proposed 100-element TLA array with those of the arrays published in [[Teruel and Iglesias (2006)], Mahenti <i>et al.</i> (2007)], and [Wang <i>et al.</i> (2012)].	44
Fig. 2-8:	Comparison of radiation patterns of the proposed 100-element TLA array with those of the arrays published in [Teruel and Iglesias (2006)], [Mahenti <i>et al.</i> (2007)], and [Wang <i>et al.</i> (2012)] in the angular sector ($\theta = 0^0-10^0$)	44
Fig. 2-9:	Optimal distribution of half of the ‘ON’ and ‘OFF’ elements at the aperture of 200-elements TLA array.	47

Fig. 2-10:	Radiation pattern of the proposed 200-element TLA array.	47
Fig. 2-11:	Radiation pattern of the proposed 200-element TLA array in the angular sector ($\theta = 0^0-10^0$)	47
Fig. 2-12:	Variation of best fitness value with number of iterations in the optimization of proposed 100-element TLA array.	49
Fig. 2-13:	Optimal distribution of half of the ‘ON’ and ‘OFF’ elements at the aperture of 100-element TLA array.	49
Fig. 2-14:	Comparison of radiation pattern of the array with all the elements turned ‘ON’ and that of the proposed 100-element TLA array.	50
Fig. 2-15:	Comparison of radiation pattern of the proposed 100-element TLA array with those of the arrays reported in [Teruel and Iglesias (2006)], [Mahanti <i>et al.</i> (2007)], and [Wang <i>et al.</i> (2012b)].	51
Fig. 2-16:	Comparison of radiation patterns of the proposed 100- element TLA array with those of the arrays in [Teruel and Iglesias (2006)], [Mahanti <i>et al.</i> (2007)], and [Wang <i>et al.</i> (2012b)] in the angular sector ($\theta=0^0-10^0$).	51
Fig. 2-17:	Variation of best fitness value with number of iterations in the optimization of proposed 100-element TLA phased array.	53
Fig. 2-18:	Optimal distribution of half of the ‘ON’ and ‘OFF’ elements at the aperture of 100-element TLA phased array.	53
Fig. 2-19:	Radiation pattern of the proposed 100-element TLA phased array at boresight ($\theta = 0^0$)	54
Fig. 2-20:	Radiation patterns of the proposed 100-element TLA phased array at scan angles of $\theta = 30^0$, 45^0 , and 60^0 with respect to antenna boresight.	54
Fig. 2-21:	Optimal distribution of half of the ‘ON’ and ‘OFF’ elements at the aperture of 100-element TLA array.	56
Fig. 2-22:	Variation of best fitness value with number of iterations in the optimization of proposed 100-element TLA array.	56
Fig. 2-23:	Comparison of radiation patterns of the proposed 100-element TLA array with those of the arrays in [Haupt (1995)], and [Teruel and Iglesias (2006)].	56
Fig. 2-24:	Comparison of radiation patterns of the proposed 100-element TLA array with those of the arrays in [Haupt (1995)], and [Teruel and Iglesias (2006)] in the angular sector ($\theta = 0^0-10^0$).	57

Fig. 2-25:	General structure of the NUSLA array with 2N elements.	67
Fig. 2-26:	Variation of PSLL with number of iterations in the optimization of the proposed 24-element NUSLA array.	73
Fig. 2-27:	Comparison of numerically evaluated radiation patterns of the proposed 24 -element NUSLA array with that of the 32-element uniformly spaced array in $\phi = 0^0$ plane.	73
Fig. 2-28:	General distribution of antenna elements at the aperture of NUSLA arrays.	76
Fig. 2-29:	Variation of optimum percentage of unequally spaced elements with total number of elements in NUSLA arrays.	76
Fig. 2-30:	Variation of peak SLL with percentage of unequally spaced elements for the proposed 16- and 32-elements NUSLA arrays.	76
Fig. 2-31:	Variations of best fitness value with number of iterations for the proposed 16-element NUSLA array and that published in [Chen <i>et al.</i> (2006)].	78
Fig. 2-32:	Comparison of synthesized elements' density taper with the corresponding Taylor taper for the proposed 16-element NUSLA array.	78
Fig. 2-33:	Normalized radiation pattern of the proposed 16-element NUSLA array.	78
Fig. 2-34:	Variations of best fitness values with number of iterations for the proposed 32-element NUSLA array and that published in [Goudos <i>et al.</i> (2010)].	79
Fig. 2-35:	Comparison of synthesized elements' density taper with the corresponding Taylor taper for the proposed 32-elements NUSLA array.	80
Fig. 2-36:	Normalized radiation pattern of the proposed 32-element NUSLA array.	80
Fig. 2-37:	Variation of best fitness value i.e. PSLL with number of iterations for the proposed 16-element NUSLA array.	82
Fig. 2-38:	Comparison of radiation pattern of the proposed 16-element NUSLA array with that of the uniformly spaced array at boresight.	83
Fig. 2-39:	Comparison of radiation pattern of the proposed 16-element NUSLA array with that of the uniformly spaced array when both are steered at 30^0 scan angle with respect to antenna boresight.	83

Fig. 2-40:	Proposed geometries of 36-element NUSLA array with dimensions corresponding to a frequency of 9.5 GHz.	85
Fig. 2-41:	Peak SLL vs. number of iterations for the SA synthesis of the proposed 36-element NUSLA array.	85
Fig. 2-42:	Numerically evaluated radiation patterns of the proposed 36-element NUSLA array.	85
Fig. 2-43:	The geometry of M-shaped patch radiating element [Aggarwal and Gangwar (2014)].	88
Fig. 2-44:	EM Simulation model of the proposed 24-element NUSLA array.	89
Fig. 2-45:	Comparison of numerically evaluated radiation pattern with that for EM simulated of the proposed NUSLA array in $\phi = 0^0$ plane	89
Fig. 2-46:	Comparison of numerically evaluated radiation pattern with that for EM simulated of the proposed NUSLA array in $\phi = 0^0$ plane in the angular sector ($\theta = 0^0$ to 30^0)	89
Fig. 2-47:	3D radiation pattern of the proposed 24-element NUSLA array.	90
Fig. 2-48:	Realized 24-element NUSLA array integrated with feed network.	91
Fig. 2-49:	Realized NUSLA array for pattern measurement in NFTR.	91
Fig. 2-50:	Sampled near field amplitude and phase of the proposed NUSLA array during pattern measurement.	91
Fig. 2-51:	Comparison of simulated and measured radiation patterns of the proposed 24-element NUSLA array.	92
Fig. 3-1:	General configuration of one quadrant of planar array with $2M \times 2N$ -elements.	107
Fig. 3-2:	Variations of overall best and averaged over 30 trials fitness value i.e. PSLI with number of iterations in the optimization of proposed 10×20 -element TPA array.	114
Fig. 3-3:	Optimal sequence of ‘active’ and ‘inactive’ elements of one quadrant (X-positive and Y-positive planes) of the proposed 10×20 -element TPA array.	114
Fig. 3-4:	Optimal distribution of ‘active’ (brown colour) and ‘inactive’ (black colour) antenna elements on the aperture of the proposed 10×20 -element TPA array.	114

Fig. 3-5:	Comparison of radiation patterns of the proposed 10×20-element TPA array with those of arrays reported in [Teruel and Iglesias (2006)], [Zhang <i>et al.</i> (2010)], [Wang <i>et al.</i> (2012)], and [Liu and Wu (2014)] in $\phi = 0^0$ plane.	117
Fig. 3-6:	Comparison of radiation patterns of the proposed 10×20-element TPA array with those of arrays reported in [Teruel and Iglesias (2006)], [Zhang <i>et al.</i> (2010)], [Wang <i>et al.</i> (2012)], and [Liu and Wu (2014)] in $\phi = 90^0$ plane.	118
Fig. 3-7:	3D radiation pattern of the proposed 10×20-element TPA array	118
Fig. 3-8:	Intensity plot of the proposed 10×20-element TPA array	119
Fig. 3-9:	Variation of mean fitness value with number of iterations in the optimization of the proposed 10×10-element UE-TPA array.	124
Fig. 3-10:	Optimal combination of ‘ON’ and ‘OFF’ elements of one quadrant (X-positive and Y-positive plane) of the proposed 10×10-element UE-TPA array. The dark gray blocks represent the ‘ON’ state of antenna element while the white ones represents ‘OFF’ state.	124
Fig. 3-11:	Optimal arrangement of ‘ON’ (yellow) and ‘OFF’ (green) antenna elements on the aperture of the proposed 10×10-element UE-TPA array.	125
Fig. 3-12:	Comparison of radiation pattern of the proposed 10×10-element UE-TPA array with those of arrays reported in [Zhang <i>et al.</i> (2010)], [Deb <i>et al.</i> (2012)], and [Nihad (2014)].	125
Fig. 3-13:	3D radiation pattern of the proposed 10×10-element UE-TPA array at antenna boresight.	125
Fig. 3-14:	Intensity plot of the proposed 10×10-element UE-TPA array at antenna boresight.	126
Fig. 3-15:	Radiation pattern of the proposed 10×10-element UE-TPA array scanned at an angle $\theta = 20^0$ with respect to antenna array boresight in azimuth ($\phi = 0^0$) plane.	126
Fig. 3-16:	Radiation pattern of the proposed 10×10-element UE-TPA array scanned at an angle $\theta = 20^0$ with respect to antenna array boresight in elevation ($\phi = 90^0$) plane.	126
Fig. 3-17:	3D radiation pattern of the proposed 10×10-element UE-TPA array scanned at an angle $\theta = 20^0$ with respect to antenna array boresight in both azimuth ($\phi = 0^0$) and elevation ($\phi = 90^0$) planes.	127

Fig. 3-18:	Intensity plot of the proposed 10×10-element UE-TPA array scanned at an angle $\theta = 20^0$ with respect to antenna array boresight in both azimuth ($\phi = 0^0$) and elevation ($\phi = 90^0$) planes	127
Fig. 3-19:	Radiation pattern of the proposed 10×10-element UE-TPA array scanned at an angle $\theta = 40^0$ with respect to antenna array boresight in azimuth ($\phi = 0^0$) plane.	127
Fig. 3-20:	Radiation pattern of the proposed 10×10-element UE-TPA array scanned at an angle $\theta = 40^0$ with respect to antenna array boresight in elevation ($\phi = 90^0$) plane.	128
Fig. 3-21:	3D radiation pattern of the proposed 10×10-element UE-TPA array scanned at an angle $\theta = 40^0$ with respect to antenna array boresight in both azimuth ($\phi = 0^0$) and elevation ($\phi = 90^0$) planes	128
Fig. 3-22:	Intensity plot of the proposed 10×10-element UE-TPA array scanned at an angle $\theta = 40^0$ with respect to antenna array boresight in both azimuth ($\phi = 0^0$) and elevation ($\phi = 90^0$) planes.	128
Fig. 3-23:	Variation of best fitness value with number of iterations in the optimization of proposed 14×14-element UE-TPA array.	130
Fig. 3-24:	Optimal positions of ‘ON’ and ‘OFF’ elements of one quadrant (X-positive and Y-positive plane) of the proposed 14×14-element UE-TPA array. The black blocks represent positions of ‘ON’ elements, while the white ones of ‘OFF’ elements.	131
Fig. 3-25:	Optimal arrangement of ‘ON’ (yellow) and ‘OFF’ (blue) elements on the aperture of the proposed 14×14-element UE-TPA array.	131
Fig. 3-26:	Radiation pattern of the proposed 14×14-element UE-TPA array at antenna array boresight in azimuth ($\phi = 0^0$) plane.	132
Fig. 3-27:	Radiation pattern of the proposed 14×14-element UE-TPA array at antenna array boresight in elevation ($\phi = 90^0$) plane.	132
Fig. 3-28:	3D radiation pattern of the proposed 14×14-element UE-TPA array at antenna boresight.	132
Fig. 3-29:	Intensity plot of the proposed 14×14-element UE-TPA array at antenna boresight.	133
Fig. 3-30:	Radiation pattern of the proposed 14×14-element UE-TPA array scanned at an angle $\theta = 20^0$ with respect to antenna array boresight in azimuth ($\phi = 0^0$) plane.	133

Fig. 3-31:	Radiation pattern of the proposed 14×14-element UE-TPA array scanned at an angle $\theta = 20^0$ with respect to antenna array boresight in elevation ($\phi = 90^0$) plane.	133
Fig. 3-32:	3D radiation pattern of the proposed 14×14-element UE-TPA array scanned at an angle $\theta = 20^0$ with respect to antenna array boresight in both azimuth ($\phi = 0^0$) and elevation ($\phi = 90^0$) planes.	134
Fig. 3-33:	Intensity plot of the proposed 14×14-element UE-TPA array scanned at an angle $\theta = 20^0$ with respect to antenna array boresight in both azimuth ($\phi = 0^0$) and elevation ($\phi = 90^0$) planes.	134
Fig. 3-34:	Radiation pattern of the proposed 14×14-element UE-TPA array scanned at an angle $\theta = 40^0$ with respect to antenna array boresight in azimuth ($\phi = 0^0$) plane.	134
Fig. 3-35:	Radiation pattern of the proposed 14×14-element UE-TPA array scanned at an angle $\theta = 40^0$ with respect to antenna array boresight in elevation ($\phi = 90^0$) plane.	135
Fig. 3-36:	3D radiation pattern of the proposed 14×14-element UE-TPA array scanned at an angle $\theta = 40^0$ with respect to antenna array boresight in both azimuth ($\phi = 0^0$) and elevation ($\phi = 90^0$) planes.	135
Fig. 3-37:	Intensity plot of the proposed 14×14-element UE-TPA array scanned at an angle $\theta = 40^0$ with respect to antenna array boresight in both azimuth ($\phi = 0^0$) and elevation ($\phi = 90^0$) planes.	135
Fig. 3-38:	Variation of peak SLL values as a function of number of iterations in optimization of the proposed TPA array.	138
Fig. 3-39:	Optimum geometrical configuration of the 10×20-elements TPA array obtained by proposed technique.	138
Fig. 3-40:	Optimal arrangement of ‘ON’ (yellow) and ‘OFF’ (green) elements on the aperture of the proposed 10×20-element TPA array.	138
Fig. 3-41:	Comparison of radiation pattern of the proposed 10×20-element TPA array in $\phi = 0^0$ plane with those of the arrays reported in [Haupt (1994)], [Teruel and Iglesias (2006)], and [Zhang <i>et al.</i> (2010)].	140
Fig. 3-42:	Comparison of radiation pattern of the proposed 10×20-element TPA array in $\phi = 0^0$ plane with those of the arrays reported in [Haupt (1994)], [Teruel and Iglesias (2006)], and [Zhang <i>et al.</i> (2010)] in the angular region ($\theta = 0^0 - 30^0$).	140

Fig. 3-43:	Comparison of radiation pattern of the proposed 10×20-element TPA array in $\phi = 90^0$ plane with those of the arrays reported in [Haupt (1994)], [Teruel and Iglesias (2006)], and [Zhang <i>et al.</i> (2010)].	141
Fig. 3-44:	Comparison of radiation pattern of the proposed 10×20-element TPA array in $\phi = 90^0$ plane with those of the arrays reported in [Haupt (1994)], [Teruel and Iglesias (2006)], and [Zhang <i>et al.</i> (2010)] in the angular region ($\theta = 0^0 - 30^0$).	141
Fig. 3-45:	3D radiation pattern of the proposed 10×20-element TPA array.	142
Fig. 3-46:	Intensity plot of the proposed 10×20-element TPA array.	142
Fig. 3-47:	Variations of PSSL value as a function of number of iterations during the optimization of proposed 10×20-element TPA array.	146
Fig. 3-48:	Optimum combinations of ‘ON’ and ‘OFF’ elements for one quadrant (X-positive Y-positive plane) of the proposed 10×20-element UE-TPA array.	146
Fig. 3-49:	Optimal arrangement of ‘ON’ (yellow) and ‘OFF’ (green) elements on the aperture of the proposed 10×20-element UE-TPA array.	147
Fig. 3-50:	Optimum combinations of ‘ON’ (Amp = ‘1’), ‘OFF’ (Amp = ‘0’) and amplitude weighted elements one quadrant (X-positive Y-positive plane) of proposed 10×20-element AW-TPA Array.	147
Fig. 3-51:	Optimum arrangement of ‘ON’ (Amp = ‘1’), ‘OFF’ (Amp = ‘0’) and amplitude weighted (‘0’ < Amp < ‘1’) antenna elements on the aperture of the proposed 10×20-element AW-TPA Array.	147
Fig. 3-52:	Normalized amplitude distributions across the array elements of the fully filled 30 dB Taylor tapered and the proposed 10×20-element arrays in $\phi = 0^0$ plane.	148
Fig. 3-53:	Normalized amplitude distributions across the array elements of the fully filled 30 dB Taylor tapered and the proposed 10×20-element arrays in $\phi = 90^0$ plane.	148
Fig. 3-54:	Comparison of radiation patterns of the proposed 10×20-element UE-TPA and AW-TPA arrays in $\phi = 90^0$ plane.	148
Fig. 3-55:	Comparison of radiation patterns of the proposed 10×20-element UE-TPA and AW-TPA arrays in $\phi = 90^0$ plane.	149
Fig. 3-56:	3D radiation pattern of the proposed 10×20-element UE-TPA array.	149
Fig. 3-57:	Intensity plot of the proposed 10×20-element TPA array.	149

Fig. 3-58:	3D radiation pattern of the proposed 10×20-element AW-TPA array.	150
Fig. 3-59:	Intensity plot of the proposed 10×20-element AW-TPA array.	150
Fig. 3-60:	Variations of best fitness i.e. PSLR value as a function of number of iterations in the optimization of the proposed 8×8-element TPA arrays.	152
Fig. 3-61:	Optimum combinations of ‘ON’ and ‘OFF’ elements for the proposed 8×8-element UE-TPA Array.	153
Fig. 3-62:	Optimal arrangement of ‘ON’ (green) and ‘OFF’ (blue) elements on the aperture of the proposed 8×8-element UE-TPA array.	153
Fig. 3-63:	Optimum combinations of ‘ON’ and ‘OFF’ elements for the proposed 8×8-element AW-TPA array.	153
Fig. 3-64:	Optimum arrangement of ‘ON’ (Amp = ‘1’), ‘OFF’ (Amp = ‘0’) and amplitude weighted (‘0’ < Amp < ‘1’) elements on the aperture of the proposed 8×8-element AW-TPA array.	154
Fig. 3-65:	Normalized amplitude distributions across the array elements of the fully filled 30 dB Taylor tapered and the proposed 8×8-element UE-TPA and AW-TPA arrays.	154
Fig. 3-66:	Comparison of radiation patterns of the proposed 8×8-element UE-TPA and AW-TPA arrays.	154
Fig. 3-67:	3D radiation pattern of the proposed 8×8-element UE-TPA array.	155
Fig. 3-68:	Intensity plot of the proposed 8×8-element UE-TPA array.	155
Fig. 3-69:	3D radiation pattern of the proposed 8×8-element AW-TPA array.	155
Fig. 3-70:	Intensity plot of the proposed 8×8-element AW-TPA array.	156
Fig. 3-71:	Architecture of the proposed 8×8-element AW-TPA array assembly with its geometrical parameters.	157
Fig. 3-72:	3D Model of radiating layer of the proposed 8×8-element AW-TPA antenna array.	158
Fig. 3-73:	Variation of return loss with frequency for one quadrant (X-negative Y-positive plane) elements of the proposed 8×8-element AW-TPA array.	158

Fig. 3-74:	Variation of mutual couplings with frequency for one quadrant (X-negative Y-positive plane) elements of the proposed 8×8-element AW-TPA array.	158
Fig. 3-75:	3D Model of feed network layer of the proposed 8×8-element AW-TPA antenna array.	159
Fig. 3-76:	Port designation for one quadrant (X-negative Y-positive plane) of the proposed 8×8-element AW-TPA array.	159
Fig. 3-77:	Variations of return loss and amplitude distributions with frequency for one quadrant (X-negative Y-positive plane) for the feed network of the proposed 8×8-element AW-TPA array.	160
Fig. 3-78:	Variations of phase with frequency for one quadrant (X-negative Y-positive plane) for the feed network of the proposed 8×8-element AW-TPA array.	160
Fig. 3-79:	Assembly of the proposed 8×8-element AW-TPA array.	161
Fig. 3-80:	Variation of simulated return loss with frequency for the sum port of the proposed 8×8-element AW-TPA array.	162
Fig. 3-81:	Simulated radiation pattern of the proposed 8×8-element AW-TPA array in $\phi = 0^0$ plane (H-plane).	162
Fig. 3-82:	Simulated radiation pattern for the proposed 8×8-element AW-TPA array in $\phi = 90^0$ plane (E-plane).	162
Fig. 3-83:	Realized 8×8-element AW-TPA array.	164
Fig. 3-84:	VSWR measurement setup of the realized 8×8-element AW-TPA array.	164
Fig. 3-85:	Pattern measurement setup in test chamber of the realized 8×8-element AW-TPA array.	164
Fig. 3-86:	Comparison of simulated and measured return loss of the proposed 8×8-element AW-TPA array.	165
Fig. 3-87:	Comparison of simulated and experimental radiation patterns of the proposed 8×8-element AW-TPA array in $\phi = 0^0$ plane.	165
Fig. 3-88:	Comparison of simulated and experimental radiation patterns for the proposed 8×8-element AW-TPA array in $\phi = 90^0$ plane.	165
Fig. 3-89:	General structure of one quadrant of the NUSPA array with $N_p \times M_p$ elements.	170
Fig. 3-90:	Proposed geometry of 8×16-element NUSPA array with dimensions corresponding to a frequency of 9.5 GHz.	173

Fig. 3-91:	Peak SLL vs. number of iterations for equally excited NUSPA array.	174
Fig. 3-92:	Numerically evaluated radiation pattern of the proposed 8×16-element NUSPA array in $\phi = 0^0$ plane.	174
Fig. 3-93:	Numerically evaluated radiation pattern of the proposed 8×16-element NUSPA array in $\phi = 90^0$ plane.	174
Fig. 3-94:	Intensity plot of the proposed 8×16-element NUSPA array.	175
Fig. 3-95:	3D radiation pattern of the proposed 8×16-element NUSPA array.	175
Fig. 3-96:	Peak SLL vs. number of iterations for amplitude weighted NUSPA array.	177
Fig. 3-97:	Numerically evaluated radiation pattern of the proposed 8×16-element amplitude weighted NUSPA array in $\phi = 0^0$ plane.	177
Fig. 3-98:	Numerically evaluated radiation pattern of the proposed 8×16-element amplitude weighted NUSPA array in $\phi = 90^0$ plane.	178
Fig. 3-99:	3D radiation pattern of the proposed 8×16-element amplitude weighted NUSPA array.	178
Fig. 3-100:	Intensity plot of the proposed 8×16-element amplitude weighted NUSPA array.	178
Fig. 4-1:	Geometrical configuration of the RSPA array (X-positive Y-positive plane) with N×M-element.	185
Fig. 4-2:	Variation in fitness value i.e. PSSL with number of iterations for the synthesis of the proposed 8×16-element RSPA array.	187
Fig. 4-3:	Antenna element distribution at the aperture of the proposed 8×16- element RSPA array.	188
Fig. 4-4:	Radiation pattern of the proposed 8×16-element RSPA array in azimuth ($\phi = 0^0$) plane.	188
Fig. 4-5:	Radiation pattern of the proposed 8×16-element RSPA array in elevation ($\phi = 90^0$) plane.	188
Fig. 4-6:	3D radiation pattern of the proposed 8×16-element RSPA array.	189
Fig. 4-7:	Intensity plot of the proposed 8×16-element RSPA array.	189
Fig. 4-8:	Variations in best fitness value i.e. PSSL with number of iterations for synthesis of the proposed 4×4-element RSPA array.	193

Fig. 4-9:	Antenna element distribution at the aperture of 4×4-element array operating at 1.5 GHz.	193
Fig. 4-10:	Radiation pattern of the proposed 4×4-element RSPA array at 1.5 GHz in azimuth ($\phi = 0^0$) plane.	194
Fig. 4-11:	Radiation pattern of the proposed 4×4-element RSPA array at 1.5 GHz in elevation ($\phi = 90^0$) plane.	194
Fig. 4-12:	3D radiation pattern of the proposed 4×4-element RSPA array operating at 1.5 GHz.	195
Fig. 4-13:	Intensity plot of the proposed 4×4-element RSPA array operating at 1.5 GHz.	195
Fig. 4-14:	Variation in best fitness value i.e. PSLI with number of iterations for synthesis of the proposed 8×8-element RSPA array.	196
Fig. 4-15:	Antenna elements distribution at the aperture of 8×8-element RSPA array operating at 3.3 GHz.	197
Fig. 4-16:	Radiation pattern of the proposed 8×8-element RSPA array at 3.3 GHz in azimuth ($\phi = 0^0$) plane.	198
Fig. 4-17:	Radiation pattern of the proposed 8×8-element RSPA array at 3.3 GHz in elevation ($\phi = 90^0$) plane.	198
Fig. 4-18:	3D radiation pattern of the proposed 8×8-element RSPA array operating at 3.3 GHz.	198
Fig. 4-19:	Intensity plot of the proposed 8×8-element RSPA array operating at 3.3 GHz.	199
Fig. 4-20:	Antenna elements distribution at the aperture of 4×4- and 8×8-elements multi-functional arrays operating at 1.5 GHz and 3.3 GHz.	199
Fig. 4-21:	Radiation patterns of the proposed 4×4- and 8×8-elements multi-functional arrays operating at 1.5 GHz and 3.3 GHz in azimuth ($\phi = 0^0$) plane.	200
Fig. 4-22:	Radiation patterns of the proposed 4×4- and 8×8-elements multi-functional arrays operating at 1.5 GHz and 3.3 GHz in elevation ($\phi = 90^0$) plane.	200