

RICHARD C. JOHNSON

ANTENNA ENGINEERING HANDBOOK

THIRD EDITION



Contents

1 INTRODUCTION AND FUNDAMENTALS

- | | | |
|----------|---|------------|
| 1 | Introduction to Antennas | 1-3 |
| | Richard C. Johnson, <i>Georgia Institute of Technology</i> | |
| 2 | Fundamentals of Antennas | 2-1 |
| | Henry Jasik, <i>AIL Division of Eaton Corporation</i> | |
| 3 | Arrays of Discrete Elements | 3-1 |
| | Mark T. Ma, <i>National Institute of Standards and Technology</i> | |

2 TYPES AND DESIGN METHODS

- | | | |
|-----------|--|-------------|
| 4 | Dipoles and Monopoles | 4-3 |
| | Chen To Tai, <i>The University of Michigan</i>
Stuart A. Long, <i>University of Houston</i> | |
| 5 | Loop Antennas | 5-1 |
| | Glenn S. Smith, <i>Georgia Institute of Technology</i> | |
| 6 | Small Antennas | 6-1 |
| | Harold A. Wheeler, <i>Hazeltine Corporation</i> | |
| 7 | Microstrip Antennas | 7-1 |
| | Robert E. Munson, <i>Ball Communication Systems Division</i> | |
| 8 | Slot Antennas | 8-1 |
| | William F. Croswell and Mary Beth Selby, <i>Harris Corporation</i> | |
| 9 | Slot Antenna Arrays | 9-1 |
| | Hung Yuet Yee and Robert C. Voges, <i>Texas Instruments, Inc.</i> | |
| 10 | Leaky-Wave Antennas | 10-1 |
| | Arthur A. Oliner, <i>Polytechnic University</i> | |
| 11 | Long-Wire Antennas | 11-1 |
| | Edmund A. Laport, <i>RCA Corporation</i> | |

12	Surface-Wave Antennas	12-1
	Francis J. Zucker, <i>Rome Laboratory, Hanscom Air Force Base</i>	
13	Helical Antennas	13-1
	Howard E. King and Jimmy L. Wong, <i>The Aerospace Corporation</i>	
14	Frequency-Independent Antennas	14-1
	Raymond H. DuHamel, <i>Antenna Consultant</i> James P. Scherer, <i>Loral Randtron Systems</i>	
15	Horn Antennas	15-1
	Allan W. Love, <i>Rockwell International</i>	
16	Lens Antennas	16-1
	Donald G. Bodnar, <i>Georgia Institute of Technology</i>	
17	Reflector Antennas	17-1
	Kenneth S. Kelleher, <i>Consultant</i> Geoffrey Hyde, <i>COMSAT Laboratories</i>	
18	Electromechanical Scanning Antennas	18-1
	Kenneth S. Kelleher, <i>Consultant</i>	
19	Frequency-Scan Antennas	19-1
	James S. Ajioka, <i>Hughes Aircraft Company</i>	
20	Phased Arrays	20-1
	Raymond Tang and Richard W. Burns, <i>Hughes Aircraft Company</i>	
21	Conformal and Low-Profile Arrays	21-1
	Robert J. Mailloux, <i>Rome Laboratory, Hanscom Air Force Base</i>	
22	Adaptive Antennas	22-1
	Leon J. Ricardi, <i>LJR, Inc.</i>	
23	Methods of Polarization Synthesis	23-1
	Warren B. Offutt, <i>W & B Observatory</i> Lorne K. DeSize, <i>Consultant</i>	
 3 APPLICATIONS		
<hr/>		
24	Low-Frequency Antennas	24-3
	Boynton G. Hagaman, <i>Kershner, Wright and Hagaman, P.C.</i>	
25	Medium-Frequency Broadcast Antennas	25-1
	John A. Lundin and Ronald D. Rackley, <i>du Treil, Lundin & Rackley, Inc.</i>	
26	High-Frequency Antennas	26-1
	Ronald Wilensky, <i>Technology for Communications International</i>	
27	VHF and UHF Communication Antennas	27-1
	Brian S. Collins, <i>Radiation Systems International Ltd.</i>	
28	TV and FM Transmitting Antennas	28-1
	Raymond H. DuHamel, <i>Antenna Consultant</i> Ali R. Mahnad, <i>Jampro Antennas Inc.</i>	
29	TV Receiving Antennas	29-1
	Edward B. Joy, <i>Georgia Institute of Technology</i>	
30	Microwave-Relay Antennas	30-1
	Charles M. Knop, <i>Andrew Corporation</i>	

31 Radiometer Antennas	31-1
William F. Croswell, <i>Harris Corporation</i> Calvin T. Swift, <i>University of Massachusetts</i>	
32 Radar Antennas	32-1
Paul E. Rawlinson, <i>Raytheon Company</i> Harold R. Ward, <i>Consultant</i>	
33 Microwave Beacon Antennas	33-1
Phillip N. Richardson, <i>Texas Instruments, Inc.</i>	
34 Tracking Antennas	34-1
Josh T. Nessmith, <i>Georgia Institute of Technology</i> Willard T. Patton, <i>General Electric Company</i>	
35 Satellite Antennas	35-1
Leon J. Ricardi, <i>LJR, Inc.</i>	
36 Earth Station Antennas	36-1
James H. Cook, Jr., <i>Scientific-Atlanta, Inc.</i>	
37 Aircraft Antennas	37-1
William P. Allen, Jr., <i>Lockheed Aeronautical Systems Company</i> Charles E. Ryan, Jr., <i>Georgia Institute of Technology</i>	
38 Seeker Antennas	38-1
James M. Schuchardt, <i>American Electronic Laboratories</i> Dennis J. Kozakoff, <i>Millimeter Wave Technology, Inc.</i>	
39 Direction-Finding Antennas and Systems	39-1
Hugh D. Kennedy and Roy B. Woolsey, <i>Technology for Communications International</i>	
40 ECM and ESM Antennas	40-1
Daniel F. Yaw, <i>Westinghouse Defense and Electronic Systems</i> Vernon C. Sundberg, <i>GTE Systems</i>	
41 Radio-Telescope Antennas	41-1
John D. Kraus, <i>The Ohio State University</i>	
4 TOPICS ASSOCIATED WITH ANTENNAS	
<hr/>	
42 Transmission Lines and Waveguides	42-3
Roderic V. Lowman, <i>Techni-Quest, Inc.</i>	
43 Impedance Matching and Broadbanding	43-1
David F. Bowman, <i>Antenna Consultant</i>	
44 Radomes	44-1
Gene K. Huddleston, <i>Martin Marietta Corporation</i> Harold L. Bassett, <i>Georgia Institute of Technology</i>	
45 Microwave Propagation	45-1
Geoffrey Hyde, <i>COMSAT Laboratories</i>	
46 Materials and Design Data	46-1
Donald G. Bodnar, <i>Georgia Institute of Technology</i>	