

TECHNICAL PROGRAM
1970 IEEE G-MTT INTERNATIONAL SYMPOSIUM

May 11-14, 1970
NEWPORTER INN, NEWPORT BEACH, CALIFORNIA

INTRODUCTORY SESSION

Monday, May 11

9:00-9:30

WELCOMING REMARKS

S. Sensiper, Chairman of the Steering Committee, 1970 IEEE
G-MTT International Symposium

KEYNOTE ADDRESS

John V. N. Granger, President IEEE

SESSION MAM-I

MICROWAVE INTEGRATED CIRCUITS I

Monday, May 11

Chairman: D. K. Adams
Wavecom, Inc.
Mountain View, California

I-1 9:40	THIN FILM LUMPED CONSTANT MICROWAVE INTEGRATED FILTER STRUCTURES, G. D. Alley, L. F. Rago and J. Shill, Bell Telephone Laboratories, Whippany, New Jersey	2
I-2 9:50	INTERDIGITAL CAPACITORS FOR USE IN LUMPED-ELEMENT MICROWAVE INTEGRATED CIRCUITS, G. D. Alley, Bell Telephone Laboratories, Whippany, New Jersey	7
I-3 10:05	LUMPED-ELEMENTS IN MICROWAVE INTEGRATED CIRCUITS IN THE 1 TO 12 GHz RANGE, R. DeBrecht and M. Caulton, RCA Laboratories, Princeton, New Jersey	14
10:25	Coffee Break	
I-4 10:45	THE APPLICATION OF DIELECTRIC RESONATORS TO MICROWAVE INTEGRATED CIRCUITS, P. L. Clar, Motorola Government Electronics Division, Scottsdale, Arizona	19
I-5 11:05	DIELECTRIC RESONATORS AS MICROSTRIP CIRCUIT ELEMENTS, W. R. Day, Jr., Litton Industries, Electron Tube Division, San Carlos, California	24

I-6 11:25	A PARALLEL COUPLED MICROSTRIP FILTER DESIGN PROCEDURE, R. A. Dell-Imagine, Hughes Aircraft Company, Ground Systems Group, Fullerton, California	29
I-7 11:45	A HIGH DIRECTIVITY MICROSTRIP COUPLER TECHNIQUE, A. F. Podell, Adams-Russell Co., Waltham, Massachusetts	33

SESSION MAM-II DIFFRACTION Monday, May 11

Chairman: L. Felsen
Polytechnic Institute of Brooklyn
Farmingdale, New York

II-1 9:40	THE DIFFRACTION OF ELECTROMAGNETIC WAVES BY DIELECTRIC STEPS IN WAVEGUIDES, E. G. Royer, U. S. Air Force Academy, Colorado, and R. Mittra, University of Illinois, Urbana, Illinois	38
II-2 10:00	RAY-OPTICAL DIFFRACTION COEFFICIENTS FOR WAVEGUIDE DISCONTINUITY PROBLEMS, A. Mohsen and M. A. K. Hamid, University of Manitoba, Winnipeg, Canada	43
II-3 10:15	ON THE RESTRICTED VALIDITY OF POINT-MATCHING TECHNIQUES, L. Lewin, University of Colorado, Boulder, Colorado	45
II-4 10:35	A FOCUSED APERTURE MILLIMETER WAVE TRANSMISSION LINE, C. O. Yowell, Aerospace Corporation, El Segundo, California	49
10:50	Coffee Break	

SESSION MAM-III LATE NEWS ITEMS Monday, May 11

SESSION MPM-I MICROWAVE FILTERS AND COUPLERS Monday, May 11

Chairman: G. L. Matthaei
University of California at Santa Barbara
Santa Barbara, California

I-1 2:00	MICROWAVE APPLICATIONS OF THE BRIDGED T, F. S. Coale and T. C. Cisco, Electronic Resources Inc., Los Angeles, California	57
I-2 2:25	SUBMINIATURE MICROWAVE ACTIVE FILTER MANIFOLDS, R. Y. C. Ho and B. Battensby, Wavecom, Inc., Mountain View, California	62

I-3 2:50	SMALL ELLIPTIC-FUNCTION LOWPASS FILTERS, R. J. Wenzel, Bendix Research Laboratories, Southfield, Michigan	66
3:15	Coffee Break	
I-4 3:35	ZOLOTAREV FUNCTIONS, A NEW DISTRIBUTED PROTOTYPE FILTER AND THE DESIGN OF MIXED LUMPED/DISTRIBUTED COMPONENTS, R. Levy, Microwave Development Laboratories, Inc., Needham Heights, Massachusetts	71
I-5 3:55	SYNTHESIS OF MULTI-SECTION NETWORKS USING THE W-PLANE, M. C. Horton, Bendix Research Laboratories, Southfield, Michigan	76
I-6 4:15	COMPACT MULTIPLEXING NETWORKS FOR L-BAND THROUGH K _J -BAND, R. J. Wenzel, Bendix Research Laboratories, Southfield, Michigan	85
I-7 4:35	A FOUR-CAVITY ELLIPTIC WAVEGUIDE FILTER, A. E. Williams, COMSAT Laboratories, Clarksburg, Maryland	90

SESSION MPM-II

MILLIMETER WAVES

Monday, May 11

Chairman: D. B. Anderson
Autonetics Division,
North American Rockwell Corp.
Anaheim, California

II-1 2:00	AN 18 GHZ DOUBLE-TUNED PARAMETRIC AMPLIFIER, Y. Kinoshita and M. Maeda, Hitachia Central Research Laboratory, Kobubunji, Tokyo, Japan	95
II-2 2:15	K-BAND, CRYOGENICALLY COOLED, WIDEBAND NONDEGENERATE PARAMETRIC AMPLIFIER, S. Takahashi, M. Nojima, T. Fukuda and A. Yamada, Tokoyo-Shibaura Electric Co., Kawasaki, Japan	100
II-3 2:30	PARAMETRIC AMPLIFICATION OF MILLIMETER AND SUBMILLIMETER WAVES: RESULTS, POTENTIALS AND LIMITATIONS, J. Edrich, National Radio Astronomy Observatory, Green Bank, West Virginia	104
II-4 2:50	MILLIMETER-WAVE MODE CONVERSION BY A SOLID-STATE MAGNETOPLASMA, K. S. Champlin and G. H. Glover, University of Minnesota, Minneapolis, Minnesota	111
II-5 3:10	A PIN DIODE FOR MM-WAVE DIGITAL MODULATION, W. O. Schlosser, J. P. Beccone and R. S. Riggs, Bell Telephone Laboratories Inc., Murray Hill, New Jersey	114

SESSION MPM-III	MICROWAVE IMAGING	Monday, May 11
	Chairman: J. C. Palais Arizona State University Tempe, Arizona	
III-1 3:50	MICROWAVE HOLOGRAPHY (INVITED), W. Kock, Bendix Research Laboratories, Southfield, Michigan	120
III-2 4:20	BINARY, DETOUR PHASE, MICROWAVE HOLOGRAPHY, G. Tricoles and E. L. Rope, General Dynamics Electronics Division, San Diego, California	124
III-3 4:40	MILLIMETER WAVE IMAGING, B. R. Feingold and B. J. Levin, RCA Advanced Technology Laboratories, Camden, New Jersey	126
SESSION MEV	PANEL DISCUSSION	7:00 P.M., Monday, May 11
	THE ENGINEER, TECHNOLOGY, AND SOCIETY	
	Chairman: J. H. Bryant Omni Spectra Farmington, Michigan	
SESSION TAM-I	COMPUTER-ORIENTED MICROWAVE PRACTICES	Tuesday, May 12
	Chairman: A. Wexler University of Manitoba Winnipeg, Canada	
I-1 9:00	CURRENT TRENDS IN AUTOMATED NETWORK DESIGN OPTIMIZATION (INVITED), J. W. Bandler, McMaster University, Hamilton, Ontario, Canada	132
I-2 9:30	COMPUTATION OF SENSITIVITIES FOR OPTIMAL DESIGN OF MICROWAVE NETWORKS, J. W. Bandler, McMaster University, Hamilton, Ontario, Canada, and R. Seviara, University of Toronto, Ontario, Canada	134
I-3 9:50	AN APPLICATION OF RAZOR SEARCH TO SEMI-LUMPED NETWORKS, B. W. Leake, Raytheon Company, Equipment Division, Wayland, Massachusetts	138
I-4 10:10	COMPUTER-AIDED DESIGN OPTIMIZATION OF BROADBAND STRIPLINE Y-CIRCULATORS, S. Okamura and T. Nagai, Toshiba R & D Center, Tokyo Shibaura Electric, Ltd., Kawasaki, Japan	141
10:30	Coffee Break	
I-5 10:50	EHPOL: AN ANALYSIS PROGRAM FOR THE ARBITRARILY SHAPED WAVEGUIDE, R. M. Bulley, Bell Telephone Laboratories Inc., Holmdel, New Jersey	145

I-6	FINITE ELEMENT SOLUTION OF DIELECTRIC LOADED WAVEGUIDES,	
11:10	P. Silvester and Z. Csendes, McGill University,	
	Montreal, Canada	150
I-7	A FINITE DIFFERENCE, FIRST-ORDER PERTURBATION METHOD	
11:30	FOR ATTENUATION IN ARBITRARILY SHAPED WAVEGUIDES, M. J.	
	Beaubien and A. Wexler, University of Manitoba,	
	Winnipeg, Canada	156

SESSION TAM-II OSCILLATOR NOISE AND Tuesday, May 12
 STABILIZATION

Chairman: D. B. Leeson
California Microwave
Sunnyvale, California

II-1 9:00	NOISE PROPERTIES AND STABILIZATION OF GUNN AND AVALANCHE DIODE OSCILLATORS AND AMPLIFIERS (INVITED), J. R. Ashley, University of Colorado, Colorado Springs, Colorado, and F. M. Palka, Sperry Microwave Electronics, Clearwater, Florida	161
II-2 9:30	CIRCUIT DESIGN FOR MINIMIZING THE FM NOISE OF A CW GUNN OSCILLATOR, A. A. Sweet, Cornell University, Ithaca, New York and Monsanto Co., St. Louis, Missouri	165
II-3 9:50	FEEDBACK CONTROL ANALYSIS OF MICROWAVE OSCILLATOR STABILIZATION WITH A TRANSMISSION CAVITY, J. G. Ondria and T. R. Turlington, Westinghouse Electric Corp., Aerospace Division, Baltimore, Maryland	166
10:10	Coffee Break	
II-4 10:35	HIGHLY STABILIZED HALF-WATT IMPATT OSCILLATOR, Shigemichi Nagano, Nippon Electric Co., Ltd., Central Research Laboratories, Kawasaki, Japan	170
II-5 10:55	CAVITY STABILIZED X-BAND GUN OSCILLATOR, Y. Ito, H. Komizo and S. Sasagawa, Fujitsu Laboratories Ltd., Kawasaki, Japan	174
II-6	MEASUREMENT OF THE NOISE IN A LINEAR TWO-PORT DEVICE, G. A. Deschamps, F. R. Ore and J. J. Sweeny, University of Illinois, Urbana, Illinois	199

SESSION TPM MICROWAVE INTEGRATED CIRCUITS - II Tuesday, May 12

Chairman: J. C. Cacheris
Motorola Incorporated
Scottsdale, Arizona

1	A NEW CLASS OF MICROSTRIP DIRECTIONAL COUPLERS,	
2:00	F. C. deRonde, Phillips Research Laboratories, Eindhoven, Netherlands	184
2	SLOT LINE FILTERS,	
2:25	E. Mariana and J. P. Agrios, Electronic Components Laboratory, U. S. Army Electronics Command, Fort Monmouth, New Jersey	190
3	RECENT DEVELOPMENTS IN MICROWAVE SLOT LINE MIXERS AND	
2:45	FREQUENCY MULTIPLIERS, J. K. Hutton and J. S. Takeuchi, Sylvania Electronic Systems, Mountain View, California	196
3:10	Coffee Break	
4	WIDEBAND X-BAND MICROSTRIP IMAGE REJECTION BALANCED MIXER,	
3:35	G. P. Kurpis and J. J. Taub, A.I.L., Division of Cutler- Hammer, Melville, Long Island, New York	200
5	LOW NOISE MICROSTRIP MIXER ON A PLASTIC SUBSTRATE,	
3:55	B. R. Hallford, Collins Radio Co., Dallas, Texas	206
6	BEAM LEAD TUNNEL DIODE AMPLIFIERS ON MICROSTRIP,	
4:15	J. D. Welch, Lincoln Laboratory, M.I.T., Lexington, Massachusetts	212
7	A MICROMINIATURE MONOSCAN CONVERTER FOR USE IN TRACKING	
4:35	ANTENNA SYSTEMS, J. J. Stitt, C. V. Bell and G. I. Tsuda, Hughes Aircraft Company, Ground Systems Group, Fullerton, California	217

PANEL DISCUSSIONS

SESSION TEV-I	THE MICROWAVE ENGINEER AND THE COMPUTER	Tuesday, May 12
---------------	--	-----------------

Organizer and
Chairman: D. Varon
Dial Data, Inc.
Newton, Massachusetts

SESSION TEV-II	APPLICATIONS OF MICROWAVE INTEGRATED CIRCUITS	Tuesday, May 12
----------------	--	-----------------

Organizer and
Chairman: J. B. Horton
Texas Instruments Inc.
Dallas, Texas

SESSION WAM-I

GUNN EFFECT DEVICES

Wednesday, May 13

Chairman: M. E. Hines
Microwave Associates
Burlington, Massachusetts

I-1 9:00	PROGRESS IN GUNN DEVICES (INVITED), Lee A. MacKenzie, Monsanto Co., St. Louis, Missouri	223
I-2 9:30	HIGH POWER GUNN OSCILLATOR DIODES ON TYPE IIA DIAMOND HEAT SINKS, M. Migitaka, M. Mivazaki and K. Saito, Central Research Laboratory, Hitachi, Ltd., Kokubunji, Tokyo, Japan	224
I-3 9:50	LINEAR MICROWAVE SOLID STATE TRANSFERRED ELECTRON POWER AMPLIFIERS WITH A LARGE GAIN BANDWIDTH PRODUCT, B. S. Perlman and R. E. Marx, R.C.A. Electronic Components, David Sarnoff Research Center, Princeton, New Jersey	227
10:10	Coffee Break	
I-4 10:35	DIRECT OBSERVATION OF LSA-RELAXATION OSCILLATION IN BULK GALLIUM ARSENIDE DIODES, R. Spitalnik, Laboratoire d'Etudes et de Recherches Generales, L.E.P., Suresnes, France	230
I-5 10:55	PIN DIODE SINGLE-SIDEBAND MODULATOR, R. V. Garver, Department of Army, Harry Diamond Laboratories, Washington, D. C.	235

SESSION WAM-II

GUIDED WAVES AND STRIPLINE

Wednesday, May 13

Chairman: P. D. Coleman
University of Illinois
Urbana, Illinois

II-1 9:00	GENERAL CONSTRAINTS UPON INHOMOGENEOUS GUIDED WAVE STRUCTURES, J. D. Rhodes, University of Leeds, Great Britain	240
II-2 9:20	POSSIBLE NEW APPLICATIONS OF PERIODIC LINEAR ARRAYS, Liang-Chi Shen, University of Houston, Houston, Texas	242
II-3 9:40	LAUNCHING OF THE HE_{11} SURFACE WAVE MODE BY AN ELECTRIC DIPOLE IN A DIELECTRIC ROD, G. L. Yip and T. Au-Yeung, McGill University, Montreal, Canada	245
II-4 10:00	A DUAL-CHANNEL ROTARY JOINT FOR HIGH POWER OPERATION, O. M. Woodward, R.C.A. Missile and Surface Radar Division, Moorestown, New Jersey	249

II-5 10:15	PHASE STABLE RIDGED WAVEGUIDE, E. Kramer, IBM Corp., Federal Systems Division, Gaithersburg, Maryland	252
10:30	Coffee Break	
II-6 10:50	CAPACITANCE MATRIX DATA FOR SINGLE, DOUBLE AND TRIPLE MICROSTRIP, A. Farrar, General Electric Co., Syracuse, New York and A. T. Adams, Syracuse University, Syracuse, New York	257
II-7 11:10	TRANSIENT ANALYSIS OF LOSSLESS, COUPLED TRANSMISSION LINES IN A NONHOMOGENEOUS DIELECTRIC MEDIUM, F. Y. Chang, IBM Components Division, Hopewell Junction, New York	262
II-8 11:30	A NEW METHOD FOR THE ANALYSIS OF THE DISPERSION CHARACTER- ISTICS OF MICROSTRIP LINES, R. Mittra and T. Itoh, University of Illinois, Urbana, Illinois	268
II-9 11:50	APPLICATION OF FERRITE TO ELECTROMAGNETIC WAVE ABSORBER AND ITS CHARACTERISTICS, Y. Naito and K. Suetake, Tokyo Institute of Technology, Tokyo, Japan	273

SESSION WPM-I

AVALANCHE DIODES

Wednesday, May 13

Chairman: R. D. Hall
Dean Hall Associates
Los Altos, California

I-1 2:00	GaAs IMPATT DIODES, OSCILLATORS AND AMPLIFIERS (INVITED), L. D. Armstrong, Microstate Electronics, Raytheon, Murray Hill, New Jersey	279
I-2 2:30	A ONE WATT CW, 20% EFFICIENT X-BAND AVALANCHE DIODE AMPLIFIER, D. M. Snider, Lincoln Laboratory, M.I.T., Lexington, Massachusetts	285
I-3 2:50	RF CURRENT AND VOLTAGE WAVEFORM MEASUREMENT OF AN OSCILLATING AVALANCHE DIODE, W. T. Chen and P. Scifo, General Telephone and Electronics Laboratories, Inc., Bayside, New York	289
3:10	Coffee Break	
I-4 3:35	HIGH EFFICIENCY SOLID STATE MICROWAVE AMPLIFIER USING TRAPATT DIODES, R. J. Hess and D. A. Floyd, Hughes Aircraft Company, Ground Systems Group, Fullerton, California	291

I-5 3:55	MULTI-EPITAXIAL AVALANCHE DIODES AT X AND K_u BANDS, M. M. Blouke, N. J. Tolar, H. M. Leedy and D. D. Khandelwal, Texas Instruments, Components Group, Dallas, Texas	295
I-6 4:15	A CIRCUIT DESIGN FOR MM-WAVE IMPATT OSCILLATORS, N. D. Kenyon, Bell Telephone Laboratories, Inc., Murray Hill, New Jersey	300
I-7 4:35	A NEW MICROSTRIP ISOLATOR AND ITS APPLICATION TO DISTRIBUTED DIODE AMPLIFICATION, M. E. Hines, Microwave Associates, Inc., Burlington, Massachusetts	304

SESSION WPM-II MICROWAVE ACOUSTICS I Wednesday, May 13

Chairman: T. M. Reeder
Stanford University
Stanford, California

II-1 2:00	MICROWAVE SURFACE WAVE DELAY LINES AS PRACTICAL PROCESSING COMPONENTS (INVITED), D. B. Armstrong and H. Skeie, Litton Industries, San Carlos, California	309
II-2 2:30	L-BAND ACOUSTIC SURFACE-WAVE TAPPED DELAY LINE, H. M. Gerard, R. D. Weglein and E. D. Wolf, Hughes Research Laboratories, Malibu, California	311
II-3 2:50	THE EFFECT OF BEAM STEERING ON THE DESIGN OF MICROWAVE ACOUSTIC SURFACE WAVE DEVICES, A. J. Slobodnik and E. D. Conway, Air Force Cambridge Research Laboratories, Bedford, Massachusetts	314
II-4 3:10	SIDE LOBE SUPPRESSION IN SURFACE WAVE ACOUSTIC DISPERSIVE DELAY LINES, W. L. Bongianni and J. H. Dickerman, Autonetics Division, North American Rockwell Corp., Anaheim, California	319

SESSION WPM-III LATE NEWS ITEMS Wednesday, May 13

SYMPOSIUM BANQUET 7:00 - 10:00 P.M., May 13

Master of Ceremonies: Robert Krausz Banquet Speaker: Harold I. Ewen

SESSION THAM-I FERRITE AND DIODE PHASE
 SHIFTERS Thursday, May 14

Chairman: G. P. Rodrigue
Georgia Institute of Technology
Atlanta, Georgia

I-1	A SURVEY OF FERRIMAGNETIC MATERIALS - STATE OF THE ART (INVITED), G. R. Harrison, Sperry Microwave Electronics Co., Clearwater, Florida	325
-----	---	-----

I-2 9:30	MANGANESE-DOPED IRON GARNETS FOR MICROWAVE LATCHING FERRITE DEVICES, D. H. Temme and F. G. Willwerth, Lincoln Laboratory, M.I.T., Lexington, Massachusetts and R. L. Hunt, Trans-Tech, Inc., Gaithersburg, Maryland	327
I-3 9:50	FERRITE MICROSTRIP PHASE SHIFTERS - THEORY AND EXPERIMENT, G. J. Buck, Hughes Aircraft Company, Aerospace Group, Culver City, California	332
I-4 10:10	A DUAL-MODE LATCHING, RECIPROCAL FERRITE PHASE SHIFTER, C. R. Boyd, Jr., Microwave Applications Group, Chatsworth, California	337
10:30	Coffee Break	
I-5 10:50	AN X-BAND RECIPROCAL LATCHING FARADAY ROTATOR PHASE SHIFTER, R. G. Roberts, Hughes Aircraft Company, Ground Systems Group, Fullerton, California	341
I-6 11:05	AN S-BAND, DUAL MODE RECIPROCAL FERRITE PHASER FOR USE AT HIGH POWER LEVELS, C. R. Boyd, Jr., Microwave Applications Group, Chatsworth, California and L. R. Whicker and R. W. Jansen, Westinghouse Electric Corp., Baltimore, Maryland	346
I-7 11:25	A 3KW MICROSTRIP AND WAVEGUIDE DIODE PHASE SHIFTER AT X-BAND, C. S. Ward, Microwave Associates, Burlington, Massachusetts	351
I-8 11:45	A HIGH POWER UHF DIODE PHASE SHIFTER, B. W. Leake, Raytheon Co., Equipment Division, Wayland, Massachusetts	355

SESSION THAM-II MICROWAVE ACOUSTICS II Thursday, May 14

Chairman: A. J. Bahr
Stanford Research Institute
Menlo Park, California

II-1 9:00	MICROWAVE NETWORK METHODS APPLIED TO ACOUSTIC SURFACE WAVES (INVITED), A. A. Oliner, R. C. M. Li and H. L. Bertoni, Polytechnic Institute of Brooklyn, Farmingdale, New York	359
II-2 9:30	THE THEORY OF RAYLEIGH WAVE COUPLING BETWEEN TWO SUBSTRATES BY MEANS OF A SOLID LAYER, K. H. Yen and R. C. M. Li, Polytechnic Institute of Brooklyn, Farmingdale, New York	365
II-3 9:50	DISTRIBUTED COMPONENTS FOR MICROWAVE ELASTIC SURFACE WAVE CIRCUITS, R. M. Knox and D. B. Owen, IIT Research Institute, Chicago, Illinois	370

10:10	Coffee Break	
II-4 10:35	ACOUSTIC SURFACE WAVE DIRECTIONAL COUPLERS, L. R. Adkins and A. J. Hughes, Autonetics Division, North American Rockwell Corp., Anaheim, California	375
II-5 10:55	OPTICAL STUDIES OF SURFACE WAVE REFRACTIVE AND REFLECTIVE DEVICE STRUCTURES, M. E. Pedinoff and M. Waldner, Hughes Aircraft Company, Research Laboratories, Malibu, California	380
II-6 11:15	SURFACE WAVE GRATING REFLECTORS AND RESONATORS, E. A. Ash, IBM Corp., Thomas J. Watson Research Center, Yorktown Heights, New York	385

SESSION THPM FERRITE COMPONENTS - GENERAL Thursday, May 14

Chairman: H. N. Chait
Aerospace Corporation
El Segundo, California

1 2:00	THE COMPACT TURNSTILE CIRCULATOR, B. Owen and C. E. Barnes, Bell Telephone Laboratories, Inc., Allentown, Pennsylvania	388
2 2:20	A COMPACT THIN FILM LUMPED ELEMENT CIRCULATOR USING A CAPACITOR COMMON TO ALL THREE ARMS, FOR BROADBANDING OR SWITCHING, R. H. Knerr, Bell Telephone Laboratories, Allentown, Pennsylvania	393
3 2:40	IDENTIFICATION OF SPURIOUS RESPONSES IN WAVEGUIDE CIRCULATORS, J. B. Castillo and L. E. Davis, Rice University, Houston, Texas	397
4 3:00	A SHORT-SLOT WAVEGUIDE LATCHING FERRITE SWITCH, S. Nakahara and H. Kurebayashi, Mitsubishi Electric Corp., Kamakura, Japan	398
3:20	Coffee Break	
5 3:40	AN ANALYSIS ON NONRECIPROCAL MICROSTRIP, J. A. Weiss, Lincoln Laboratory, M.I.T., Lexington, Massachusetts	404
6 4:00	MICROWAVE SIGNAL PROCESSING BY AMPLIFIED FERRIMAGNETIC ECHO, R. M. Hill, D. E. Kaplan, G. F. Herrmann and S. K. Ichiki, Lockheed Palo Alto Research Laboratory, Palo Alto, California	409
7 4:20	BANDPASS AND BANDSECTIONING FILTERS USING EPITAXIAL YIG FILMS, W. L. Bongianini, Autonetics Division, North American Rockwell Corp., Anaheim, California and L. Young, Stanford Research Institute, Menlo Park, California	414