IEEE NEWSLETTER

ELECTROMAGNETIC COMPATIBILITY GROUP

Number 35 October 1964

CHAPTER ACTIVITIES

Boston:

Two meetings have been held by the MIL-EMC Group: One on April 30, 1964 at which time D. Brainerd Holmes of the Raytheon Co. gave a talk on "NASA & Dept. of Defense Space Programs"; and another meeting on May 13, where R. Wayne Crawford, Scientific Columbus, Inc., Columbus, Ohio, gave a paper on "Hall-Effect Devices as a Tool in Magnetic Measurements".

Cape Canaveral:

A meeting was held on May 13, 1964 and Joe Berger, Stoddart Aircraft Radio Co., Hollywood, Calif. gave a paper on "Instrumentation Requirements for System Compatibility Analysis".

Chicago:

The following meetings have been held by this Chapter: February 4, 1964, paper titled "Comparisons between MIL-STD-826, MIL-I-26600, & MIL-I-6181D" presented by William Schwagart and Cliff Hemming of Electro-Magnetic Compatibility Div. of Potter Co.; March 12, 1964 - paper titled "EI Shielding of Ground Support Equipment Connectors" by Allen Wheat, The Pyle-National Co.; April 7, 1964 - paper on "Instrumentation Requirements for System Measurement & Analysis" by Joseph E. Berger, Stoddard Aircraft Radio Co., and June 16, 1964 - paper on "Electro-Magnetic Compatibility in Switches" presented by Kenneth Jauch, Microswitch Corp., Freeport, Ill.

Los Angeles:

There were two meetings held: One on January 23, 1964 at which time Ward S. Cayot, Northrop Corp., Hawthorne, Calif., gave a paper on "Industrial Frequency Management"; another meeting was held on September 17, 1964 and papers were presented on "Self-Improvement - Key to Selling EMC" by Frank Fern, Admiral Corp., - "An Aerospace Dilemma - The Incompatibility of Electromagnetics and Necessary Pyrotechnic Devices" by Jerry Milano, Hughes Aircraft Corp.

Metropolitan New York:

A meeting was held on February 13, and a paper was presented by Dr. L. Castriota, PRD Electronics, on "Radiometers".

Seattle:

There was a meeting held on January 22, 1964 and a paper titled " A Communications System Computer Model & Some Validation Techniques" was presented by Charles E. Blakely, Bell Aerosystems Co.

Magnetic Fields from Power Lines:

Electrical Design News carried a 1-page magnetic-field nomograph in the May 1964 issue with self-explanatory comments by George Feinman, Andrea Radio Corp., L. I. C., New York.

Correlation of the Phase of Microwave Signals:

IEEE Transactions on Antennas and Propagation, Volume AP-11 Number 6, November 1963, carries a 1-page article under the title - "Correlation of the Phase of Microwave Signals on the Same Line-of-Sight Path at Different Frequencies" by H. B. James, Central Radio Propagation Lab., Boulder Labs., NBS, Boulder, Colo.
The first paragraph states:

> "It is well known that microwave signals sent over line-of-sight paths in the troposphere are characterized by random variations in phase and amplitude caused by variations in the atmospheric refractive index along the propagation path. Several experiments have been conducted to measure time variations in the phase of a signal sent over one path, and variations in the phase difference of two signals sent over adjacent paths at essentially the same frequency. However, these experiments shed no light on the relative phase and amplitude variations of two signals sent over the same path at slightly different frequencies."

Text of Congressional Bill:

The EMC Newsletter or August 1964, page 2, carried a news item about the bill introduced into Congress to permit the FCC to force compliance by manufacturers with regulations covering RFI emission. The bill introduced into the Senate and identified as S. 2684 reads as follows:

A Bill

"To amend the Communications Act of 1934, as amended, to give the Federal Communications Commission authority to prescribe regulations for the manufacture, import, sale, shipment, or use of devices which cause harmful interference to radio reception.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Communications Act of 1934, as amended, is further amended by adding thereto a new section 302 to read as follows

"Devices Which Interfere With Radio Reception

"Sec. 302. (a) The Commission may, consistent with the public interest, convenience, and necessity, make reasonable regulations governing the interference potential of devices which in their operation are capable of emitting radio frequency energy by radiation, conduction, or other means in sufficient degree to cause harmful interference to radio communications. Such regulations shall be applicable to the manufacture, import, sale, offer for sale, shipment, or use of such devices.

"(b) No person shall manufacture, import, sell, offer for sale, ship, or use devices which fail to comply with regulations promulgated pursuant to this section.

"(c) The provisions of this section shall not be applicable to carriers transporting such devices without trading in them, to devices manufactured solely for export, or to devices for

use by the Government of the United States or any agency thereof. Devices for use by the Government of the United States or any agency thereof shall be developed, procured, or otherwise acquired, including offshore procurement, under United States Government criteria, standards, or specifications designed to achieve the common objective of reducing interference to radio reception, taking into account the unique needs of national defense and security."

Evaluation of Attenuators and Matching Networks:

Electrical Design News, May 1964, carries three nomographs on two pages of editorial comment by J. H. Fasal, Asst. Chief Engineer, Kidde Ultrasonic & Detection Alarms, Div., Walter Kidde & Co., Clifton, New Jersey. The title of the article is "Three Nomographs For the Evaluation of Attenuators and Matching Networks."

Performance of Matched Filter Receivers in Non-Guassian Noise Environments:

John C. Lindenlaub, Assistant Professor of Electrical Engineering, Purdue University, Lafayette, Indiana, delivered a paper under the above title at the 10th National Communications Symposium, October 5-7, 1964, in Utica, N. Y. The summary and first paragraph of the introduction are as follows:

"The performance of a matched filter receiver structure, designed under the assumption of an additive white gaussian noise environment, is investigated when operating under various non-gaussian noise conditions. A theoretical development is made which predicts the behavior of the matched filter receiver when subjected to ideal impulse noise. These results, along with the performance in an environment of clipped gaussian noise and combinations of gaussian and impulse noise, are then verified experimentally. The results show that in the probability of error range of most interest 20 to 30db more signal power is necessary to achieve the same probability of error in an impulse noise environment than in a gaussian noise environment."

"This paper reports the results of a study to determine how rapidly the performance of a receiver employing matched filter processing, the optimum receiver under the assumption of additive gaussian noise, degrades when the receiver is placed in a non-gaussian noise environment. Motivation for this work stems from the fact that the optimum receiver in the non-gaussian case is often nonlinear making its analysis and construction difficult. As a result systems are often designed around the gaussian assumption even though it is known that it will be used in a non-gaussian environment. Thus it becomes important to know how much margin must be allowed in the design to ensure satisfactory performance in the non-gaussian noise case."

Copies may be obtained by writing Professor Lindenlaub at the School of EE, Purdue University.

JTAC Becomes Actively Interested in EMC:

The Joint Technical Advisory Committee, which is composed of representatives from IEEE and EIA, and is in an advisory capacity to various government agencies, has undertaken a general survey of technical and economic problems of electromagnetic compatibility. It formed a subcommittee 63.1 with R. P. Gifford, of General Electric, Lynchburg, Va., as chairman. Mr. Gifford has reported the activities of this subcommittee in the IEEE Vehicular Communications Group Newsletter, August 1964, as follows:

"Since 1961 JTAC has endeavored to stimulate the interest of engineers in the increasing technical and economic problems of electromagnetic compatibility. In November 1962 the FCC advised that it planned to continue and expand its study of man-made noise and inquired as to JTAC's plans in this area. JTAC members and the secretary have conferred with representatives of federal agencies and industry to determine the various activities and the extent of interest in interference control and reduction. This included two classified presentations, one by the Chief Signal Officer at the Pentagon, and the other by the Tri-Service Electromagnetic Compatibility Center at Annapolis. In November 1963 JTAC established a Subcommittee (63.1 - Electromagnetic Compatibility) under the chairmanship of Mr. Richard P. Gifford to explore the neglected areas and to initiate educational and remedial studies.

"Dr. Jerome B. Wiesner, Acting Special Assistant to the President for Telecommunications, on December 6, 1963, advised "There is a need for consolidation and clarification of the technical programs leading to the enhancement of electromagnetic compatibil and for leadership in developing national policy and adequate officia recognition and support of this work in the United States. . . . It is suggested that the Joint Technical Advisory Committee might well consider becoming a focal point for initial study of needed technical programs, and for the formulation of objectives for dealing with this subject as a national problem." Upon receipt of Dr. Wiesner's letter, the Subcommittee 63.1 was directed to turn its attention to the challenge presented.

"One of the many sub-tasks involved in the work of 63.1 is a general survey of present conditions in allocation techniques and procedures, and some on-the-spot surveys that will demonstrate the physical nature of actual problems in electromagnetic compatibility. One of the areas chosen for survey is Los Angeles where the local people have accumulated a fairly good picture of congestion in the land mobile frequencies. The study group assigned to this area will, of course, also concern itself with activity in interference problems in other parts of the spectrum in Los Angeles as well."

Mr. Gifford also mentioned that "JTAC is working on the publication of an updating of its earlier book 'Radio Spectrum Conservation.' The new book will be titled 'Radio Spectrum Utilization.' The work was compiled through the efforts of a subcommittee chaired by Mr. Philip Siling. It will not only provide a rather complete up-to-date reference on the technical factors involving the utilization of the radio spectrum, but it also will have much to say on some of the basic concepts and philosophies that need to be adopted in allocation of this national resource. The book will be available late in 1964."

RFI in the Soviet Union:

John J. O'Neil, Deputy Director, Electromagnetic Environment Division, Fort Monmouth, N. J., has written a 3-page article in the September 1964 issues of Signal under the above title. The sub-title states:

"This article is based on a Soviet Specification and is believed to be of general interest to the many contractors who are working in, or concerned with, the problem of Radio Frequency Interference."

Interference Suppression in Marine Craft:

The Telecommunications and Electronics Branch of the Department of Transport, Ottawa, Canada, has published a 26-page report titled "Interference Suppression in Marine Craft" and identified as Circular SII-10-47. Chapter headings are:

Introduction
List of Applicable Specifications and Circulars
Limits of Interference
Measuring Methods - Aerial
Measurement Methods - Appliances

And Appendices include the following:

A. Nature and Causes of Interference.
B. Measures relating to Radio Receiving Installations.
C. Measures relating to Wiring Installations.
D. Measures relating to Electrical Machinery and Appliances.
E. Suppression of Ignition Interference.
F. Aerial Systems and Ships Rigging.
G. Principles of Suppression.

Joseph L. Ryerson Appointed SHAPE Technical Director:

Joseph L. Ryerson, formerly with the Rome Air Development Center, Rome, New York, was appointed technical director of SHAPE (Supreme Headquarters- Allied Powers of Europe) at the Hague, Netherlands. Among other societies to which he belongs, he is a member of the IEEE Electromagnetic Compatibility Group.

NAVSHIPS Design Manuals Now Available:

The six Design Manuals developed by the Bureau of Ships for use by equipment designers are now available to qualified DOD contractors from the Defense Document Center (DDC). The Manuals are as follows:

NAVSHIPS 94327 - "Miscellaneous Interference Considerations in Switching Circuit Design" - Contract NObsr 72789 - January 1961.

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NAVSHIPS 94328 - "Interference Considerations in Terminal Equipment Design" - Contract NObsr 72789 - January 1961.

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NAVSHIPS 94329 - "Interference Considerations in Receiver Design" - Contract NObsr 72789 - January 1961.

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NAVSHIPS 94330 - "Interference Considerations in Transmitter Design" - Contract NObsr 72789 - January 1961.

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NAVSHIPS 94331 - "Interference Considerations in Radar Design" - Contract NObsr 72789 - January 1961

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NAVSHIPS 95938 - "Interference Studies, Investigations, and Tests Concerning Electric Arc-Producing Devices" - Final Report Contract NObsr 72681 - November 30, 1960.

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Electronic 'Bug' New Menace to Aircraft:

Leslie H. Whitten, Hearst Headline Service, wrote the following article which appeared on July 26, 1964 and is being reprinted by permission of the Boston Sunday Advertiser:

"Washington - Electronic eavesdropping devices - 'bugs' - can bring down aircraft by jamming communications systems, two Federal agencies have determined in secret field tests.

"The Federal Aviation Agency (FAA) in a heretofore 'confidential' and undisclosed report, tells of tests at Kennedy International Airport;

Atlantic City, N.J. and Potomac, Md. The Federal Communications Commission (FCC) ran its trials from an Agriculture Department airfield in Beltsville, Md., and at Washington's posh Mayflower Hotel.

"The results learned by this correspondent, are essentially the same:

"If located inside a plane a 'bug' can block navigational aids, electronic landing devices and voice communication. The threat of disaster in such a case is enormous.

Hotel Bugged

"On the ground, even ten miles away, the tiny 'bug' can interfere sufficiently with navigational beams and voice transmission to turn planes from their path and garble or cancel voice orders.

"The tests grew from discovery in 1962 of a 'bug' in the Mayflower Hotel in the suite of a lawyer for a multi-million dollar natural gas firm. Industrial espionage was suspected.

"Asst. U.S. Atty. Harold Sullivan found among other aspects of the case that FCC regulations provided penalties for unauthorized transmissions on aeronautical wave lengths. He suspected 'bugs' could produce a freak air crash through radio interference or might already have blacked out radio signals - where blackouts were blamed on weather or other conditions.

"The FAA and FCC ran tests on the bug, and its carrying range was 'greater than anticipated,' said an FCC report drawn up after the Beltsville test.

Five Miles Away

"Flying in a light plane on May 3, 1962, with an ordinary "Narco' receiver, FCC engineers monitored the 'bug' - which was on the ground - at 1000 and 10,000 feet and from up to five miles away.

"The FAA, which up to that time had been mainly concerned with the threat of 'bugs' inside aircraft, then began its secret tests. But despite frightening revelations, the FAA has taken no decisive action.

"At New York's (then) Idlewild Airport, an American Airlines Convair 990 jet was used for ground tests. A bug was put in various parts of the plane and finally as far away from the cockpit as possible - in the toilet. From every location it gave off sufficient power to jam the short range navigational aids and the landing instrument.

Dramatic Test

"The FAA ran an air test at Potomac in which the 'bug' on the ground carried 10 miles to a plane at 1300 to 1500 feet.

"The Atlantic City test was even more dramatic. In an FAA laboratory, a bug was set up 40 feet from an ordinary 'Collins' aircraft radio receiver. Under these simulated flight conditions, the Atlantic City navigational transmitter - only one mile away - was 'made unusable' for the receiver the FAA report said.

"Radio interference from some such device was suspect in a fatal crash near Charlottesville, Va., which he investigated in 1959, but the cause was never firmly established, he said."

The FCC provided the following information:

The bug was about as big as king size package of cigarettes. For an antenna, it used a piece of ordinary insulated wire about 2 feet long. The overall power drain was about 40 milliwatts and the frequency nominally 115 MHz was sensitive to antenna position. Moving or approaching the antenna could cause a frequency change up to 1 or 2 MHz.

Frank Kratokvil New Chief FCC Field Engineering Bureau:

George S. Turner, Chief of the Field Engineering Bureau of the FCC retired effective August 1st and Frank M. Kratokvil, his assistant for the last 16 years, has been appointed to replace him. From 1934 to 1939, Mr. Kratokvil served as Inspector in Charge of the FCC field engineering office in Dallas, and the next two years similarly headed the Buffalo field office. During World War II he was Supervisor of the Commission's Radio Intelligence Division for the South Atlantic area. In 1946 he was brought to Washington to be Chief of the Monitoring Branch and, four years later, was promoted to Assistant Chief of the then Field Engin eering and Monitoring Division, becoming Deputy Chief in 1963.

Designing Noise Immunity into High-Speed Circuits:

Electronics, September 7, 1964, carried a 7-page article under the above heading by Donald R. Gipp, Radio Corp. of America, Somerville, N.J. The sub-head and first two paragraphs are:

"Noise is a serious problem in diode transistor logic. Here's a way to plan for a desired 'percent noise immunity'.

"As ultrahigh-speed switching transistors become more common in circuits using diode-transistor logic, noise control becomes an increasingly serious problem.

"Now a systematic approach has been devised to determine the noise immunity of diode-transistor logic circuits in terms of circuit design parameters. A procedure to optimize noise immunity for a given circuit fanout (driving capability) is then presented."

Crashes of Model Planes Laid to Walkie-Talkies:

The New York Times of September 3, 1964 carried the following news item:

"London (AP) - Radio controlled model airplanes flown by hobbyists west of London were behaving recently as though suicide pilots had taken over.

"Outraged model builders blame Japanese-made walkie-talkies that have just come on the market here. They operate on a fixed frequency the same as the one allotted by the British Post Office for the remote-control planes.

"The model builders are reported to have temporarily grounded their planes, which cost up to $300, and are building directional radio sets to track down the offending signals."

Low-Noise Traveling-Wave Tubes:

Microwaves, September 1964, has the following articles on the above subject:

"Low-Noise Traveling-Wave Tubes" is an article by J.B. Brinton, Jr., New Products Editor, listing approximately 90 tube specifications. The sub-title as follows:

"Properly applied, the TWT can compare with masers and paramps, offering fine bandwidth, stability and dynamic range. Here is a guide for the engineer to help select the low-noise TWT best for his application."

"How to Buy a Low-Noise-Traveling-Wave Tube" is a long article by C. Louis Cuccia, Director, Research and Engineering Microwaves Electronics Corp., Palo Alto, Calif., the sub-titled is:

"Low noise alone is not the entire story. If you want the most for your money pay attention to structure, gain, dynamic range and power supplies. Keep in mind also that quiet tubes generally are heavier than noisier ones. And finally, don't ever specify (unless you're still working on a CPFF contract)."

Saturn Specs Tightened to Reduce RFI:

Bob Ward, Fairchild News Service, has an article in the Sept. 7, 1964 issue of Electronic News under the above heading. The first 4 paragraphs are as follows:

"Huntsville, Ala. - Upgraded specifications to reduce radio frequency interference (RFI) hazards to launch vehicle electronics have been adopted by Marshall Space Flight Center, NASA, in a move expected to have far-reaching effects on Project Apollo hardware.

"The new standard (MSFC-SPEC-279) provides more stringent test requirements regarding system electromagnetic compatibility, subsystem interference and subsystem susceptibility.

"It now applies to the instrument units of the Saturn IV and Saturn V vehicles and to 'all future contracts' involving Saturn electronics, a Marshall spokesman told Electronic News.

"The change is also requiring development of automatic test equipment for generation of radio frequency interference signals and measurement of sub-system response, said James C. Toney of the MSFC Quality and Reliability Assurance Laboratory in an interview."

Stray Signals Can't Throw This Desensitized Switch:

A 4-page article by John M. Gault, International Rectifier Corp., El Segundo, Calif., and Richard J. Sanford, Naval Ordnance Lab., White Oak, Md., in Electronics, July 27, 1964, discusses discrimination between r-f energy and a d-c pulse by using an extra zener junction. The first two paragraphs are as follows:

"Spurious radio-frequency interference can trigger a semiconductor switch with disastrous results. For example, a circuit used with an explosive load such as a warhead detonator could be set off by a spurious r-f signal. The switch must be designed to reject unwanted r-f energy and accept the desired d-c pulse that triggers it.

"The switch shown (page 69) meets these requirements. It is triggered by a small d-c signal. Any stray r-f signal, induced between the gate and cathode, will not energize the load. The device can be used instead of pnpn switches in applications where signal interference might be a source of trouble. Diagram B (page 69) shows a lumped component equivalent of the desensitized switch.

"The Firing Level

"The operation of the desensitized pnpn switch is best understood by examining the structure of an ordinary pnpn switch, on p. 69, bottom. Construction begins with a single crystal of pure silicon. Four alternating layers of p and n material form the three interacting pn junctions. In the diagram, from bottom to top, these junctions consist of the emitter or cathode, the collector, and the conjugate emitter or anode. The two lower junctions form, in effect, a high-gain npn transistor. The upper two junctions form a low-gain pnp transistor. Both transistors use the same collector. The normal alpha, or d-c common-base forward current, of each transistor increases with collector current at low currents. Since the transistors are connected for positive feedback, the device switches on when the collector current rises to such a value that the sum of the alphas exceed unity. A forward bias of about one-half volt must be placed across the emitter junction to raise the collector current to a value that will fire the switch. And so any d-c or r-f signal, which can raise the emitter to about one-half a volt can fire the switch."

Items of Interest from Proceedings of the IEEE, July 1964:

Microwave Signal-to-Noise Performance of CdSe Bulk Photoconductive Detectors

The above article is by M. DiDomenico, Jr., and L. K. Anderson, Bell Telephone Labs., Inc. Murray Hill, N. J. The summary states:

"The microwave signal and noise response of CdSe bulk photoconductive detectors have been measured and compared with that of a high-speed junction photodiode. The signal measurements were made with CW intensity modulated light at 3000 Mc. Excellent quantitative agreement was obtained between the simple photoconductivity theory of direct light demodulation and experiment. At low optical intensities, the observed noise can be accounted for within the framework of existing theories of generation-recombination (GR) noise when the effects of electron retrapping are accounted for. At high optical intensities, nonlinear deviations are observed which can be accounted for only qualitatively. The results demonstrate clearly that such a photoconductor, when used as a simple quantum counter, will always be thermal rather than GR noise limited.

"Measurements show that the photoconductor as it is usually used in a nonoptimum configuration is some 50 db less sensitive than a good photodiode."

Noise in Adler Tubes

In the Correspondence section, starting on page 868, is a letter by Alfred Frohlich, Birkbeck College, University of London, London, England. The first two paragraphs are as follows:

"This communication is concerned with the numerical evaluation of a theory that correlates the total available noise power in an Adler electron-beam parametric amplifier with the degree of scalloping of the electron beam. The theory is based on the asymmetry of the parallel plates of a Cuccia coupler with respect to the circular cross section of the beam. The computations produce the same rate of increase of noise with scalloping as the experiments(1).

"It is proposed that, without any external RF modulation, the asymmetry of the coupler plates sets up an asymmetric electric field that tends to perturb the motion of the center of mass of the beam. This perturbation of the rotating beam induces a current in the coupling circuit that in turn can remodulate the beam as a fast cyclotron wave. The amplitude of this current will depend on the initial stability of the beam at the entry to the coupler plates, that is, on the degree of scalloping of the beam envelope. The induced energy comes from the total transverse noise energy on the beam."

Discussion of Slip Rings:

Alfred J. Ferretti, Managing Editor of Electromechanical Design, 167 Corey Road, Brookline 46, Mass., has written a 17-page section in the Systems Designer's Handbook, July 1964, on Slip Rings. There are several paragraphs on such subjects as Slip Ring Noise, Mechanically Initiated Noise, Electrical Noise, Designing Around Noise and Radio Frequency Noise.

Articles from Electronic Design, August 3, 1964:

Military Comsat System Very Much Alive

A news article by Ralph Dobriner discusses a proposed design for a scanning antenna as follows:

"A proposed design would enable small ground stations to communicate via a military satellite without interference or jamming.

"The scheme, proposed by the Hughes Aircraft Co., Los Angeles, could provide interference-free communication over a single voice channel to a satellite at synchronous altitudes - using a dish antenna as small as 2 ft across.

"The field of view for a synchronous satellite covers a large portion of the earth's surface; the ground-to-satellite link must contend with interference from enemy or uncoordinated friendly sources possessing higher powers and gains. Therefore, it is virtually impossible for a small ground terminal to communicate even at very low data rates.

"Hughes suggests that such a satellite employ a directional receiving antenna which would scan its field of view and effectively eliminate all interfering stations outside of a window around its ground transmitter.

"The company proposes using a 1-deg beam at 40 Gc. Electronic scanning (using phase shifters) is effected in one dimension and satellite spin provides the second dimension of the 'raster.'

"Frame synchronization signals are transmitted by the satellite on the down link. The small ground station, recognizing its own position relative to the scan starting point, can then compute the time it is under observation by the satellite antenna.

"The present Syncom antenna system consists of 16 multiple pole antenna elements, eight ferrite phase shifters, and a fairly complex control circuit.

"This results in a pencil beam of 17.3 deg, which compensates for the satellite spin and maintains the beam directed at the earth.

"To modify the Syncom antenna to provide a 1-deg pencil beam at 40 Gc would require about half-wave (3.75 mm) elements in either dimension, according to Hughes. The company points out that the complexity of such an array means that scanning could probably be effected in one direction only, thereby producing a sweeping fan beam. Despite this drawback the fan-beam configuration would still offer a 25-db advantage over a conventional system, Hughes maintains."

Collector Tap Improves Logic Gating

A 6-page article by R. Bohn, and R. Seeds, Fairchild Semiconductor Div., Fairchild Camera and Instrument Corp., Mountain-View, Calif., has the following to say on Noise Immunity and Beta Under Worst-Case Situation:

"Another of the important design considerations in determining the resistor tap point in the DTL gate design is the noise rejection of the gate element under worst-case operating conditions. The worst-case situation would occur when a DTL gate operating at -55 C is fanning out to the maximum number of similar circuits, whose individual AND gate resistors are of a minimum value. Any noise on the ground or supply line that would reduce the net supply voltage on the drive gate will reduce the base drive to the inverter transistor. This is illustrated in Fig. 3a. If the noise potential V_{ng} is sufficiently large, a false logic '1' will propagate through the fan-out gates. A plot of the worst-case noise immunity vs the resistor ratio factor p, for fixed transistor betas, is shown in Fig. 3b for $V_{cc} = +4.0$ v. It shows that a substantial reduction in the minimum beta required and improvement in worst-case noise immunity are obtained by using a collector-tapped design.

"For example, if $\pm$ 400 mv of ground-line noise immunity is required at -55 C, then a conventional DTL circuit would need a minimum beta of 24 at that temperature. This would require a minimum +25 C beta of 60. Using a collector-tapped design, with a resistor ratio factor p equal to 0.45, the minimum -55 C beta is reduced to approximately 12 and the minimum +25 C beta is reduced to about 30."

Integrating Spacecraft Electronics:

Space/Aeronautics, August 1964, carries a 7-page article under the above titled by Arnold B. Whitaker, Lem Systems Project Engineer, and Charles Schuhlein, Head Lem Electronic Integration, Grumman Aircraft Engineering Corp. It discusses the various types of electromagnetic interference, their causes, and methods of attenuation. The first two paragraphs are as follows:

"It is a matter of record that a vast majority of our flight delays and failures results from electronics. The malfunction of the TV cameras on Ranger 6 is the most publicized of recent incidents. Although causes of this failure are still not known, official guesses are being made that debris floating in zero g and/or coronas developing in space vacuum aborted system operation.

"What is interesting about these guesses is that they are being made not in the area of component failure as such, but in the area of spurious interactions between equipments and environments. The problem, on a broad scale, is one of electromagnetic compatibility." . . . .

Special Graphs Simplify Design of Low-Noise Amplifiers:

J. Wesley Baker, Sperry Semiconductor Div., Sperry Rand Corp., Norwalk, Conn., has a 4-page article in the August 17, 1964 issue of Electronic Design under the above title. Two paragraphs of interest are as follows:

"The design of a low-noise amplifier involves more than the selection of a 'low-noise' transistor. In fact, such a device may produce considerable noise in the circuit if not properly matched to the amplifier.

"Thus, the problem is to supply the design engineer with sufficient information on the noise characteristics for a wide range of situations. Fortunately, this information can be presented in an easy-to-use form by noise-figure contour maps....."

Articles of Interest from Electronic Design:

Suppression of Extraneous Pulses in PCM Signals

A 2-page article by Stanley Teich, Grumman Aircraft Engineering Corp., Bethpage, N. Y. The sub-title is as follows:

"Extraneous pulses in signals can seriously hamper digital communication. Using pulse width discrimination these unwanted pulses are eliminated by a digital delay circuit."

Output Stages Prevent Circuit Noise Interference

Dan Hobaugh, senior electronics engineer, Recognition Equipment Inc., Dallas, Texas, has drawn a simple schematic on page 53 to illustrate the following:

"Properly connected output stages protect a switching circuit, such as a flip-flop, from being triggered due to noise spikes on the output lines. This occurs when the noise spikes forward-bias the collector to base junction of the output transistor (Q_2 or Q_4) and cause the flip-flop to change state."

Shielding Module Interconnections:

Electronic Packaging and Production, August 1964, carries an 8-page article by Leo Fiderer, Aerospace Group, Hughes Aircraft Co., Culver City, California, under the above title. The first paragraph is as follows:

"Current design and construction of electronic digital computers follow two major trends: Faster pulse-repetition rates and increasing module-packaging densities. These developments add to the problems presented by interconnecting lines; close control of the electrical properties of the module interconnections is required."

Hewlett-Packard Brings Out Booklet on Spectrum Analysis:

Hewlett-Packard Co., 1501 Page Mill Rd., Palo Alto, Calif. has brought out a 44-page booklet on Spectrum Analysis. It is designated as Application Note 63. The Table of Contents is as follows:

Electronic Filters:

TT Electronics, Inc., P.O. Box 180, Culver City, Calif., has reprinted an article from the February 1936 issue of Industrial Electronic Engineering & Maintenance titled "Electronic Filters" by Joseph F. Sodaro. The sub-title and first paragraph are as follows:

"Understanding filter circuits makes test setup a routine check-out procedure.

"Filters appear more and more in electronic equipment in packaged form. Since these networks cannot be traced in hermetically sealed or encapsulated packages, it is helpful to have some knowledge of filters to understand how they work in the overall system. This knowledge makes repair and testing simpler."

Microwave Interference Avoidance:

Microwave Services International, Inc., Denville, N.J., has reprinted a 4-page article from Telephony, April 25, 1964, by Victor J. Nexon, President. The title of the reprint is "Microwave Interference Avoidance". The sub-title and first paragraph are as follows:

"Increase in congested areas makes proper engineering in site selection important.

"Microwave mileage for private, common carrier and governmental agencies is fast approaching one million route miles. In this process of fantastic growth, there has developed a number of congested microwave environments that present difficulties to the designer of new microwave systems through such areas. All indications point to an increase in the number of congested areas and the importance of proper interference avoidance engineering in the site selection process for a new system."

A 7-page brochure, which includes sample microwave system map charts titled "Precision Maps and Station Data for Microwave Interference Avoidance - Engineering Tools for New Systems Planning and Existing Systems Protection", is available on request.

NEW PRODUCTS:

New Low Density Aluminum-Ceramic Material

The U.S. Department of Commerce has issued a bulletin on the above material, the first two paragraphs of which state:

"A new low density aluminum-ceramic material produced by the Army's Harry Diamond Laboratories is structurally superior to any previously made metallic combination. In addition, the new material is less costly to make than any other lightweight material known.

"The filled aluminum has a virtually continuous outer skin, and this may be readily removed by etching, exposing the filler particles. Attractive textural and ornamental effects can be created in this way. This procedure also permits the new material to be used in friction applications such as stair treads, clutches, brakes, and as an abrasive. Other likely uses are for containers, lightweight appliances, thermal barriers, fastener plugs, and in shock and vibration damping."

The report can be ordered through a Field Office of the U.S. Department of Commerce, the identification of which is as follows:

AD 602 413N - A Low Density Aluminum Ceramic Material -- $2.00

New Shielded Window by Metex

Metex Electronics, Walnut Ave., Clark, N.J., has developed a new shielded window called POLA-VU. It is a fine knitted mesh sandwiched between plexiglass and is designed for high visibility, high attenuation and easy access for maintenance.

EDITORIAL NOTE:

This is an interim issue to clear the deck for items with more news value. As has been mentioned in past issues, there is a time lag between submitting copy for the newsletter and the final printing and mailing. If we have to hold items up for editorial review, then they come out after the event.

Your editor is still very anxious to get incidences of side-effects of electromagnetic energy. He wishes to thank all of those who have already written in incidences and finds some of those hard to believe. Please include, with all incidences, frequency, amplitude of energy, length of things affected and any other details which might be of value. The length of the antennas of ants, for example, determined the frequency which affected them.

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