IEEE NEWSLETTER

ELECTROMAGNETIC COMPATIBILITY GROUP

MAY - 1965

Issue No. 38

NOTES ON AD COM MEETING MARCH 23, 1965

The following officers were elected for the 1965-55 term:

Chairman: A. H. Sullivan, Jr., Manager
Washington District
HRB Singer, Inc.
1000 Connecticut Ave., N. W.
Washington, D. C. 20036

Vice Chairman: John J. Egli, Director
Electromagnetic Environment Div.
U. S. Army Signal Research and
Development Laboratory
Fort Monmouth, N. J.

Secretary: Leo W. Thomas, Staff Electronics Eng.
Plans & Programs Directorate
Electromagnetic Compatibility
Analysis Center
Annapolis, Md. 21402

Treasurer: Richard B. Schulz, Chief
Avionics Integration
The Boeing Company
Airplane Division
Renton, Wash. 98055

The Administrative Committee Members, with their terms of office, are as follows:

1966

Rexford Daniels
Interference Consultants, Inc.
150 Causeway Street
Boston 14, Mass

Herman Garlan
Fed. Communications Com.
Washington 54, D. C.

Harold Dinger, Code 5416
U. S. Naval Research Labs.
Anacostia, Md.

John E. Maynard
The Boeing Company
Aerospace Division
Seattle 24, Wash.

A. H. Sullivan, Jr.
HRB Singer, Inc.
Washington 36, D. C.

1967

John J. Egli
U.S. Army Signal Research
and Development Lab.
Fort Monmouth, New Jersey

Fred J. Nichols
Genistron, Inc.
6320 West Arizona Circle
Los Angeles 45, Calif.

Zigmund V. Grobowski
Grobowski and Associates
1500 Massachusetts Ave., N.W.
Washington, D. C. 20005

Henry Randall
Office of Communications and
Electronics
ODDR&E - The Pentagon
Washington, D. C. 20301

Ralph M. Showers
Moore School of Electrical Engineering
University of Pennsylvania
200 South 33 Street
Philadelphia 4, Pa.

1968

John A. Eckert
Norair Division
Northrop Corporation
Hawthorne, Calif.

James J. Krstansky
IIT Research Institute
10 West 35 Street
Chicago, Illinois 60616

Stanton A. Bennett
Bureau of Yards and Docks
U. S. Navy
Washington 25, D. C.

Richard B. Schulz
The Boeing Company
Airplane Division
Renton, Washington 98055

Leonard W. Thomas
Electromagnetic Compatibility
Analysis Center
Annapolis, Maryland 21402

The Ad Com noted with great interest and approval the efforts by the Chapters to run educational courses. The Chicago Chapter plans to continue its educational course for the second year and details will appear in a forthcoming Newsletter.

Vellar C. Plantz, 15414-88th Ave., N. E., Bethell, Washington 98011, stated that the Seattle Chapter had started a section in the Seattle Public Library on electromagnetic compatibility. This was established for the use by engineering students and by outside engineers who wish to learn something about electromagnetic compatibility. Mr. Plantz stated that he would be very glad to receive any contributions for this Library and that they should be mailed directly to him. A complete file of the Newsletters is being assembled and will be sent to Mr. Plantz.

Membership as of January 27, 1965 was:

Members -	1403
Students -	21
Affiliates -	10

CHAPTER ACTIVITIES

Boston

The Military Electronics/Electromagnetic Compatibility Group met on April 15, 1965 at which time William C. Morton, AFESD, gave a paper on "Spacetrack."

Chicago

A meeting was held on Nov. 12, 1964 at which time W. Johnson gave a paper on "The Role of Management in Electromagnetic Compatibility." The paper was written by J. Krystansky.

Huntsville

Two meetings have been held by this Chapter: One on Sept. 13, 1964 wherein Leonard Milton, Filtron Co., Inc., Flushing, N. Y., gave a paper on "History of RFI At Home and Abroad;" another meeting was held on Jan. 19, 1965 and papers were given on "EMC Management" by W. McKerchar, McDonnell Aircraft, St. Louis, Mo., and "Transient Susceptibility Testing" by D. Williams also of Mc Donnell Aircraft.

Los Angeles

There were two meetings held: One on Jan. 21, 1965 at which time Sam Sabaroff, Research Scientist of Hughes Aircraft Co., presented a paper on "Electric Charge Accumulation and Dissipation on Spacecraft;" another meeting was held on March 18, 1965 and Joe Fischer, Chief Engineer for Genistron, Inc., presented a paper on "A Computer Study of the Insertion Loss of EMI Filters in Mismatched Systems."

Mohawk Valley

A meeting was held on Jan. 26, 1965 and a paper was presented on "A New Guide to the Control of Electromagnetic Interference -- Specification MIL-STD-826" by Fred Moore, Rome Air Development Center, Rome, N. Y.

Metropolitan New York

The following meetings have been held: June 18, 1964 - paper presented by M. Revzin, Loval Electronics Corp., New York, on "A Practical Discussion of RFI Integration, A Complete System"; Oct. 27, 1964 - paper presented on "Field Intensity Measurements" by E. W. Chapin, Laboratory Div. FCC, Washington, D. C., and Samuel J. Burruano, Burruano Assoc., Harrington Park, N. J.; Dec. 15, 1964 - paper given on "Comprehensive EMC Program at Mc Donnell" by Walt McKerchar, McDonnell Aircraft, St. Louis, Mo., and Feb. 16, 1965 - paper given on "Radiation Hazards Program" by Paul C. Constant, Jr., Midwest Research Institute, Kansas City, Mo.

Philadelphia

On Dec. 8, 1964 the Instrumentation & Measurement/Electromagnetic Compatibility Groups held a meeting and a paper was presented on "New Developments in RFI Instrumentation and Their Application" by Robt. Friedman, Polarad Electronic Instruments, Long Island City, N. Y. Another meeting was held by the Electromagnetic Compatibility Group on Feb. 11, 1965 and papers were presented on "UHF Receiver Interference Reduction Techniques" by Robt. Sugarman, American Electronic Labs., Colman, Pa., and "Broadband Susceptibility Testing" by E. Stanley Warchaizer, General Electric Co., Valley Forge, Pa.

San Francisco

A meeting was held on Nov. 24, 1964 at which time a paper was presented by W. D. Hayter, IBM, San Jose, Calif. on "High Voltage Nonosecond Duration Power Line Transients".

Seattle

Two meetings have been held: One on Nov. 30, 1964 and F. A. Spelman, University of Washington, Seattle, Wash. presented a paper on "Electrical Interferences in Bio-Medical Instruments"; another meeting was held on Jan. 28, 1965 and B. T. Mills, Cenistron, Inc., Los Angeles, Calif., presented a paper on "A Graphical Method for the Analysis & Synthesis of Electromagnetic Interference Filters".

CORONA: WHAT IT IS; DAMAGE IT CAUSES; HOW TO AVOID IT

Electronic Products, a United Technical Publication, in its April 1965 issue, carries a 3-page article under the above title by Louis C. Galambos, Consultant, Rowe Industries, Inc., Toledo, Ohio. The subtitle and first section are as follows:

"A knowledge of the presence or absence of corona discharge can be helpful in controlling quality and reliability of high volgage connectors and cable terminations and other components.

"Are you as designers and specifiers of electronic components giving enough attention to the effects of corona?

"Will it cause a vehicle to fail in flight after elaborate static ground tests have been performed?

"Should you not consider the existence of corona a factor causing premature component failure?

"Shall its absence be considered an indication of high reliability?"

ELECTRICAL NOISE

Electromechanical Design, April 1965, has two columns of an article titled "Miniature Slip Ring Assemblies" dealing with electrical noise. The first paragraph states:

"Generation of electrical noise in sliding contacts is in all probability the most difficult problem with which both the user and manufacturer of slip rings must cope. The major portion of noise in slip ring assemblies can be attributed to dynamic resistance characteristics or variation in contact resistance as a function of rotary motion; - of the materials used, surface finish of materials, contact pressure, ring concentricities and assembly techniques. Noise may also increase with normal usage due to wear or galling of the slip ring."

DESIGNING THE MISSILE-BORNE ELECTRONIC PACKAGE

In Electronic Packaging & Production, April 1965, is a 4-page article under the above title by Harold B. Nicholas, Senior Design Engineer, General Dynamics/Astronautics, San Diego, Calif. The first paragraph is as follows:

"The simplest package using discrete components would consist of nothing but the components, the interconnecting wiring, and the electrical interface to the outside. To be realistic, some means must be included to hold all of these parts in the proper relationship to each other. However, in order to avoid structural over-design and keep the simple package as a goal, it is always helpful to re-examine periodically the functions of a package which would apply to all of its uses."

PARAMETRIC PRINCIPLES IN OPTICS

L. P. Kaminow, Bell Telephone Labs. Inc., has written a 9-page article in the April 1965 issue of the IEEE Spectrum under the above title. The subtitle and first paragraph are as follows:

"In this introduction to the newly developing field of nonlinear optics, emphasis is placed upon the similarities and the intrinsic differences between optical processes and the equivalent radio-frequency processes.

"The development of the optical maser has made available for the first time a light source with the same properties as conventional radio-frequency sources; that is, the output may be formed into a plane wave oscillating at a single frequency. These new sources have been used to demonstrate phenomena that were previously unknown at optical frequencies but have long been familiar at radio frequencies, namely, harmonic generation, mixing, heterodyning, modulation, and parametric amplification, all by means of nonlinear reactances. Most of the processes involved in the new field of nonlinear optics can be understood in terms of parametric mixing and amplification. In the optical case, the refractive index is varied by means of the nonlinear response of the medium. (The optical dielectric constant is the square of the index of refraction.)"

IS DB PASSE FOR COMPONENT NOISE?

In the April 26, 1965 issue of Electronic Design, Jack O'Neill, Airborne Instruments Lab., Deer Park, N. Y., has written a 2-1/2 page article under the above title. The subtitle and first three paragraphs are as follows:

"What happens to the sensitivity of your system when you change a component? Find out with a graph that replaces decibels with temperature for the noise figure of components.

"Determining the effect of changing the noise figure of one component on a complex system is not a simple task. The accepted standards for components and systems are expressed in different terms (in db and in temperature), further complicating the work of the system designer.

"The system designer uses the operating noise temperature to compare the noisiness of systems, while the component engineer has a standard - the noise figure (expressed in db) - to evaluate components.

"These two concepts can be brought together in a single graph to help both systems and component engineers by using temperatures exclusively to characterize noise power sources. This means that the noise power can be accounted for by a termination at a specified temperature."

ELECTROMAGNETIC COMPATIBILITY

Electromechanical Design, March 1965, has digested several papers given at the 10th Tri-Service Conference in Chicago, November, 1964. The papers digested are:

"Effectiveness of Spectrum and Selectivity Control in Reducing Mutual Interference in a Typical Radar Environment," L. Katz and R. D. Parlow of ITT Research Institute, Electromagnetic Compatibility Analysis Center, Annapolis, Md.

"A New Approach to Radar Spectrum Signature Recording" by A. E. F. Grempler, Bendix Radio Div., Bendix Corp., Baltimore, Md., and A. P. Carlson, Rome Air Development Center, USAF, N. Y. Reference was made to A. L. Albin's paper on transistor switch development.

ITEMS OF INTEREST IN ELECTRICAL DESIGN NEWS, March 1965

Techniques of RC Spark Suppression

Jerry Ihrig, Application Engineer, Bourns, Inc., Riverside, Calif., has written a second part of a three-part series on contact protection. The subhead and pertinent paragraph are as follows:

"An electromechanical relay is inherently unrealible - when improperly applied. This basis tenet concerning relay reliability is accepted universally. Yet how often does the telephone refuse to work when the receiver is lifted? Considering that dozens and possibly hundreds of relays must work properly when a call is placed, it is apparent that the electromechanical relay has established quite a reliability record.

"RFI Reduction

The RC network has proved very effective in reduction of RF noise. Since it reduces the magnitude of the inductive transients, it is apparent that it would reduce troublesome RFI. It should be remembered that the primary function of the RC network is to extend the usable life of the relay contacts. It is, therefore, not uncommon practice to parallel two suppressor circuits if RF noise suppression also is required. For example, the first circuit, the resistor-capacitor, would be used to protect the contacts, while the second, a voltage-sensitive resistor, could be used to minimize the RF noise generated upon contact opening."

Capacity of Shielded Wires

R. S. Smith, Aerospace Div., Westinghouse Defense and Space Center, Baltimore, Md., has written a page article under the above title with an accompanying nomograph. The subtitle is as follows:

"A good high-frequency circuit can be foiled if the signal cannot be conducted properly between source and load. The capacitance of the interconnecting cable is an important factor in conducting this signal."

ARTICLES OF INTEREST IN ELECTRO-TECHNOLOGY

Electro-Technology, 205 East 42nd Street, New York 17, N. Y. is conducting a Science and Engineering series which has occasional articles of interest in the field of electromagnetic compatibility.

In the November, 1963 issue was an article by Arthur Glaser, Radiometrics, Div. of Polarad Electronics Corp., under the title "Electric and Magnetic Fields." In an editorial comment on the article, the following paragraphs are of interest:

"Just as the study of the gravitational field (based on Newtonian theory) provides the background for classical mechanics, the study of electric and magnetic fields (based primarily on Maxwellian principles) provides the essentials necessary to an understanding of classical electrical engineering.

"In this month's Science & Engineering feature, the author starts his discussion of electric and magnetic fields with electrostatics, where the concern is with phenomena exhibited by electric charges at rest. The laws governing these phenomena are derived from Coulomb's law. The effects of charge distribution in free space and material media and in dielectrics (to make a broad separation in materials where design is concerned) are considered here.

"Having considered electrostatic phenomena, it is next important to know what happens in a medium where the electrons are free to move about so that an electric current (the flow of electric charge across a reference surface) is established. The force existing between two such current-carrying conductors sets up another type of field, which is of course the basic principle involved in rotating machinery."

In the November 1964 issue was an article by J. H. Vogelman, Technical Consultant, Clavier Corp., under the heading "Transmitter-Receiver Pairs in EMI Analysis." The subhead and first two paragraphs are as follows:

"Electromagnetic interference in systems involves interaction of essentially simple elements. Analysis is made complicated by the sheer number of elements. However, methods are available for pinpointing those elements which are the most likely sources of interference.

"Prediction of electromagnetic interference (EMI) - whether that generated by a system or that to which a system is subject - must start with an analysis of very simple elements. The approach is to examine combinations of these elements (i. e., transmitter-receiver pairs) to find whether the output from a given transmitter is large enough to cause interference in a given receiver. Here, of course, we use 'transmitter' and 'receiver' in a very general sense to refer to any bodies capable of radiating or collecting electromagnetic energy.

"This is an apparently simple question. However, to resolve it in real situations requires coping with many complicating factors. There are usually many transmitters and receivers which are capable of interacting. All sources of electromagnetic energy within the frequency range of interest must be considered. In the r-f range, for example, not only communications and radar transmitters and radio receivers must be considered, dioide input circuits and low-level servo signals are also potential transmitters or receivers. To compound the problem, direct data, such as the power-frequency spectrum of the transmitter and the sensitivity-frequency spectrum of the receiver, are almost never available. These data must be calculated from other information. The quantity and complexity of transmitter-receiver interactions are such that manual calculations are impractical; computer analysis is not only more economical, but almost mandatory."

In the January 1964 issue was an article by Chas. L. Marquardt, U. S. Naval Research Laboratory, under the title "The Near Electromagnetic Field." The editor's comments on this article contain the following paragraphs of interest:

"In analyzing the electromagnetic field produced by an antenna, the problem is greatly simplified if the observation point is in the 'far' field. Here, the induction components of the electromagnetic field vanish. The standard equations for antenna fields are based on the assumption that induction terms are negligible, and therefore they are applicable only in the far field.

"In the 'near'field, signals can easily be made highly directional and limited to circumscribed regions. These properties, combined with low power requirements and small antenna size, offer advantages in certain applications, notably in short-range military communications. Such applications have created a need for knowledge of the behavior of fields within the near region. How does field strength vary over the region? How does the signal vary with receiving antenna orientation at a particular observation point? What effects do reflecting surfaces - earth and water - have on the field? These and other questions motivate the analysis of the near fields.

"Where does the near field end and the far field begin?..."

Graphical Approach to Electromagnetic Shielding

Under the above title, FREQUENCY, March/April 1965, carried a 7-page article by W. S. Adams, General Dynamics/Astronautics, San Diego, Calif. This article is based upon a paper presented at the 10th Tri-Service Conference on Electromagnetic Compatibility, Chicago, Illinois, November 1964. There are 10 Figures and 1 Table. The subtitle and first paragraph are as follows:

"Tailor-made for designers of solid metallic shielding configurations, this article reduces the cumbersome isolation equations to a relatively-simple graphical form. By providing a sound framework into which measured data on the properties of materials may be inserted, author Adams shows how to rapidly evaluate the significance of design parameters and select optimum materials and dimensions for specific applications.

"When undesirable coupling of electromagnetic energy exists between an interference source and a susceptible device the common solution is to provide intermediate shielding. Both the interference source and the susceptible device may be thought of as antennas, one transmitting and one receiving. Occasionally mutual coupling can be reduced to a tolerable level by simply rearranging these 'antennas' geometrically; more often the designer must specify the minimum shielding required to provide the necessary isolation."

WHY NOT THE AVALANCHE DIODE AS AN RF NOISE SOURCE

Under the above title, Electronic Design, April 12, 1965, carried a 2-page article by Hays Penfield, 75 Elm St., Concord, Mass. The subtitle and first three paragraphs are as follows:

"Stable, broadband RF noise signals as high as 1 Gc can be obtained from silicon junction-avalanche diodes. These diodes are particularly useful for receiver sensitivity-checking.

"Complex and sensitive RF receiving equipment to be operated automatically at remote locations requires a simple and reliable means for the checking and monitoring of receiver sensitivity. One of the most useful types of signal sources for this testing is a broadband noise signal generated by the avalanche diode.

"Conventional noise sources of the temperature-limited diode type of gas-discharge variety suffer from relatively high power consumption and size and weight problems. This makes them somewhat unattractive for use in portable operations or spacecraft applications.

"Recent investigations into the noise-producing characteristics of Zener and avalanche diodes have indicated that these devices may be used to produce a stable RF noise signal up to a maximum frequency of about 1 Gc."

MEASURING DC RELAY COIL TRANSIENTS

Electronic Industries, April 1965, carries a 4-page article by Robert D. Goldblum, Development Engineer, American Electronic Labs., Inc. Richardson Rd., Colmar, Pa., under the above title. The subtltle and first paragraph are as follows:

"It is no surprise that relays generate transients. But most engineers do not realize the magnitude and duration of these transients that create RFI and can burn out parts. Here are the results of some tests, along with suggestions for reducing transients.

"It is almost common knowledge among engineers that dc relays, inductive switches, and similar devices are generators of transients. However, what is not realized is the extent of magnitude and duration in which these transients occur. Since these devices operate mostly from a 28vdc supply source, they imagine transients occuring up to 3 or 4 times the voltage rating, or 100 v, and for a short undefined duration. Actually, transients from these devices can exceed 600 v and last for durations measured in tenths of a millisecond. It is for this reason that the following tests were performed."

Suppressing Relay Coil Transients

Electronic Industries, April 1965, carries a 2-page article by John S. Jordan, Asst. Chief Engineer, Struthers-Dunn, Inc., Pitman, N. J. under the above title. The subtitle and first paragraph are as follows:

"Relay coils generate inductive 'kicks' which create high level transients. Several methods of transient suppression are described here. Selection of suppression must be done with care to minimize the effect on relay release time.

"The problem of coil transients generated when relay coils are de-energizing has been covered in an article, 'Measuring DC Relay Transients,' authored by Mr. Robert Goldblum, of American Electronic Laboratories. Since some of the relays in the article were made by Struthers-Dunn, Inc., we feel it is worthwhile to present some methods of suppressing these transients and show the effects of each on the release time of a relay, as well as the suppression of the inductive 'kick.'"

ITEMS OF INTEREST IN ELECTRONIC DESIGN, MARCH 29, 1965

Variable Threshold Integrated Logic Immune to Noise

In a news story containing one schematic and one chart are the following first three paragraphs:

"A technique called variable threshold logic (VTL) has been developed to meet the need for greater noise immunization in integrated-logic circuits.

"VTL is also said to be less sensitive to temperature change than the conventional diode-transistor-logic.

"The new technique, described by Richard A. Gissell of the Semiconductor Products Div. of Motorola, Inc., Phoenix, Ariz., was developed last fall. Its distinction is that the input threshold of the circuit is adjustable over a wide range. This variability is accomplished by an external bias-potential control. Moreover, 'the threshold setting is relatively insensitive to temperature effects because of a built-in compensation for diode-drifts with thermal change,' Gissel says."

Broadband Masers May Ease Crowded Communication Nets

In another news story, under the above title, are the first three paragraphs:

"A maser with a bandwidth of 500 Mc at 5 Gc is on the way to making communication between earth and space stations more economical.

"The device, now being tested at Airborne Instruments Lab., Deer Park, N. Y., is said to have a gain of 27 db and a noise temperature of around 10 deg K. When used in a receiver, it would improve the signal-to-noise ratio, and so increase the number of channels allowable.

"Airborne's engineers achieve the exceptionally wide band through a technique called transverse field staggering, in which all frequencies are amplified simultaneously in a comb structure. Conventional masers have a bandwidth of around 20 Mc and the convention technique involves amplification along the direction of propagation. Here, each frequency is amplified separately, resulting in losses tha limit the bandwidth."

Noise in Electrostatic Recording

IEEE Spectrum, March 1965, mentions on page 229 a paper in the IEEE Transactions on Audio, Nov.-Dec. 1964, under the above title by J. J. Brophy, D. E. Richardson, H. Seiwatz, as follows:

"Playback noise in electrostatic recording is due to random electric charge patterns on and in the dielectric tape record. Surface charges on the tape may be neutralized by passing the tape through an ion bath and this greatly reduces the playback noise level, particularly at low frequencies. The noise of such neutralized tapes may be interpreted in terms of a random array of charged regions in the tape having an average diameter of 0.04 cm and a charge density of 5 eus/cm^2. Charge injection during recording changes this charge pattern but results in a similar array of smaller charged spots, 3×10^{-5} cm in diameter. This recorded noise is due to the sparklike character of the recording discharge and may be reduced by generating a continuous discharge."

A CONSIDERATION OF VCO AND THERMAL PHASE NOISE IN A COHERENT TWO-WAY DOPPLER COMMUNICATION SYSTEM

IEEE Spectrum, page 241, March 1965 issue, mentions a paper in the IEEE Transactions on Space Electronics and Telemetry, under the above title by J. K. Holmes. The summary is as follows:

"An analysis of a coherent two-way (transponder) Doppler communication system composed of a ground transmitter, a spacecraft transponder, and a ground receiver has been made to determine the effects of VCO phase and thermal phase noise at the ground receiver output. This system is typical of those used on lunar and planetary space programs. The analysis shows that the phase noise contribution of the ground receiver's VCO is inversely proportional to the ground receiver's noise bandwidth. Further, it has been shown that the spacecraft VCO phase noise, spacecraft thermal phase noise, and ground receiver thermal phase noise are all functions of the ratio of transponder-to-ground-receiver noise bandwidths. All the relationships were derived through the use of complex integration techniques."

DETERMINING EFFECTIVENESS OF HARMONIC OUTPUT FILTERING

Electronic Products, March 1965, carries a 3-1/2 page article with 8 figures, under the above title, by Lawrence R. Pangburn, Light Military Electronics Dept., General Electric Co., Utica, N. Y. The subtitle and first two paragraphs are as follows:

"Harmonic filters in transmission lines that lead to antennas can be ineffective in producing true characteristic-impedance insertion-loss values. The author tells how to correct this problem with proper impedance matching.

"Actual effectiveness of a transmitter harmonic filter, when inserted in the transmission line to the antenna, can vary over a wide range. It extends both above and below the standard characteristic-impedance circuit insertion-loss values. The location in this range varies with interconnecting transmission line lengths. For example, the actual insertion loss of a 60 db filter could be anywhere between 10 db and 94 db. Furthermore, the transmitter harmonic power delivered to an antenna, in the absence of a filter, can also vary with the length of the interconnecting transmission line.

"These effects are produced by changes in mismatch loss which occur as the length of interconnecting transmission line is varied. Determining the range of variation of such effects is of interest to many designers of communication equipment."

SOLDER BALLS ARE A LARGE CAUSE OF TRANSISTOR FAILURES

Signal, March 1965, carried the following news item:

"One reason for the failure of vital electronic circuits in missiles, satellites and other communications and surveillance equipment - when this happens for seemingly insignificant cause - has been discovered by engineers at the U.S. Army Electronics Laboratories, U.S. Army Electronics Command, Fort Monmouth, New Jersey.

"Electronics engineers at Fort Monmouth found that certain types of transistors can be temporarily disabled by tiny balls of solder that form when the transistor is subjected to an abnormal transient surge of power. These solder balls can break loose under vibration or other mechanical movement and touch critical areas of the transistor, causing a brief short circuit - inducing circuit failure. Not infrequently, guilty transistors may test out perfectly after such a failure because the ball has moved out of its temporary shorting position. Though the solder problem has been known about for years, it was usually blamed on inadequate manufacturing control and inspection. The team of engineers of Edward B. Hakim, Luke K. McSherry and Bernard Reich explored the solder ball phenomenon and pinpointed the villain - tin, one of the principal solder ingredients.

"Every possible cause of the solder ball formation was explored enlisting the aid of microscopes and high-speed motion pictures for dynamic analysis. High-speed, motion-picture microphotography in color was performed by the team of Leo A. Fary, Director and Ocie S. Riddle, Cameraman. Their film revealed that the solder balls formed in less than a microsecond and also showed the location where the solder balls 'popped' up and their movement.

"The team of engineers then applied electrical power in various manners to high-power silicon alloy-diffused transistors and to high reliability medium power silicon alloy transistors, always in a way that would produce surges of high peak powers.

"They discovered that current or voltage modes of stress could cause constriction in current paths that resulted in localized hot spots reaching temperatures as high as 1300 degrees F. Under such conditions, solder balls invariably formed in those transistors which used tin solder as the basic material and usually started in the emitter area of the transistor.

"The results of their experiments as summarized were: 1. Balls can form when local termperatures in excess of 416 degrees F exist. 2. These temperatures are reached either by electrically (surge) induced hot spots or external heating. 3. The ball is 99 percent tin, the main ingredient of the emitter and base regions. 4. Electrical performance of the transistors frequently is not initially affected by formation of the balls, and 5. The balls remain physically attached to the device at the point of formation until mechanically jolted loose.

"The conclusion of the experiments calls for the substitution of other basic contacting materials than tin - perhaps lead, aluminum or various alloys with higher melting temperatures."

AMPLIFIER CAN BE ADJUSTED TO CANCEL UNBALANCED NOISE

In the Designer's Casebook, page 60, of Electronics, Aug. 24, 1964, is an article by Joseph R. Smith, Jr., NASA, Moffett Field, Calif., under the above title. The first three paragraphs, which describe a schematic, are as follows:

"Signals from electrodes attached to a person's body had to be amplified for input to an electrocardiograph. A compact amplifier was needed that would amplify low-level signals in the presence of relatively large variable noise signals, and that would operate on a low voltage supply. The a-c amplifier shown met the requirements.

"The circuit provides a high common-mode rejection ratio - approximately 10,000 to 1 - and adjustable cancellation at the input for unbalanced noise signals. Cancellation for unbalanced noise is particularly important in biomedical applications because the input terminals are often widely separated on the body and noise levels may differ.

"The circuit's adjustable voltage gain eliminates the need for matched input transistors. Operating on a four-volt d-c supply, the circuit requires eight milliwatts of power to produce a one-volt peak-to-peak output with a 3.6 millivolt input signal."

HRB SINGER INC. DEVELOPS FAA FALSE RADIO SIGNALS EQUIP.

Signal, February 1965, carries the following news on page 66 with the title "HRB Singer, Inc., under contract to the Federal Aviation Agency (FAA) as follows:

"H R B Singer, Inc., under contract to the Federal Aviation Agency (FAA), has developed equipment to detect, identify and locate sources of false radio signals that interfere with navigational aids.

"Installed in an FAA flight inspection DC-3, the equipment examines signals in the frequency bands of the navigational aids and, by homing the aircraft on any emitting object in that band, locates the source of any interfering signal. After the approximate location is determined, tape recordings relay emitter characteristics and location data to ground mobile vans which precisely locate the emitter.

"The equipment comprises a set of sweep-tuned receivers with forward-looking antennas in each band and a cathode ray tube display console common to all three bands. It is designed to operate in three frequency bands - VOR and VHF communications between 100 and 152 mc; glide slope from 320 to 345 mc; and the Tactical Air Navigation band from 950 to 1225 mc."

BEEFING UP MOON PHOTOS

Electronics, March 8, 1965, carried an article by Wm. B. Wallace, Los Angeles Regional Editor, under the above title. Paragraphs of interest are as follows:

"The computer converts the 90,000 points that make the picture into 90,000 six-bit words. This provides 64 possible degrees of shades between dead white and black for each point. A new tape of the digitized signal is made and then processed through a link film recorder.

"When the system was first used with Ranger 7 pictures, the results were disappointing; the quality of the picture appeared to decrease rather than increase. Close examination, however, revealed that an increase in picture resolution had brought up noise interference not discernible in the original cathode ray tube reproduction.

II. Noise Problem

"Nathan analyzed the interference pattern and determined that it was caused by an oscillator in the vidicon erasing system of an adjacent camera. Through computer analysis, he developed the noise pattern and was able to produce a picture of the noise alone. By nulling the pattern signal, he was able to remove the noise from the picture, and thus achieved the improvement he sought.

"Other noise interference that can be removed or greatly reduced includes the mesh noise that is detectable in calibration pictures, ghosting noise caused by retention of previous image on the vidicon, and clamp-error noise causing a shift of intensity for the whole video line. The distortion-correction crosses and other such fiducial marks can also be removed.

"The digitized tape might save otherwise lost pictures. It will be much easier to find the line sync in a weak signal. If a picture should fall out of sync and be ripped into unintelligible confusion, it might be salvagable on the new tape. Correction for photometric distortion caused by nonuniformity in camera sensitivity will be possible, as will correction for geometric distortions caused by nonlinear sweep deflection in the camera."

ITEMS OF INTEREST FROM ELECTRONIC DESIGN, MARCH 1, 1965

Shipboard Radar Safety Standards Studied

The following was part of the Washington Report appearing on page 19:

"The Navy is taking a new look at personnel safety standards for shipboard radar. Several years ago a radiation limit on a person of 0.01 watts per cm^2 was placed on the average field-power density of any one device. The theory was that anyone could be exposed to any average power density below the limit for an indefinite period without fear of injury.

"However, some radar devices presently being designed for shipboard use are as much as 1000 times as powerful as World War II installations. These new devices have extremely high but brief peak intensities. The current limit was calculated in terms of a relatively low peak power for a longer duration. Navy physiologists point out, concluding that 'the radiant energy, therefore, per duty cycle has an altogether different time history from what can be expected of the new high-power devices.' "

Estimate Total Noise of RFI Sources

On pages 26 and 27 are 2 charts and a box containing the formula used. The subtitle and the first three paragraphs are as follows:

"A graphical method to find the combined noise level of simultaneously operating sources.

"By a simple, graphical method it is possible to sum decibels directly, without establishing absolute power levels.

"Consider a situation where noise and/or signal is present from several sources and being transmitted parallel to a single susceptable linear network. Since power levels are usually given in decibels, the product rule associated with the logarithmic operation is no longer valid.

"To evaluate the total noise level, for example, the engineer has to convert all decibel values to absolute power levels, sum the components and convert the result back to decibels."

INCREASING INFORMATION TRANSFER

Harold Gruen, Manager, and Benjamin Olevsky, Section Manager, Advanced Communications Laboratory, Philco Corp., have written an 8-page article in the February 1965 issue of Space/Aeronautics with the above title. The subtitle and first four paragraphs are as follows:

"To meet demands for more and more data from our spacecraft, we are developing practical techniques for giving us up to 100:1 increases in information transfer. These techniques could mean faster transmission of TV data from lunar and planetary vehicles, and many more voice channels for milicomsats.

"Many different communications systems are being studied for future space missions such as comsats, Apollo, and advanced interplanetary probes. Varied as they are, they all foresee the need for substantial increases in the rates of transmission of telemetry, television and voice information.

"However, a substantial increase in information rate may not be easy to come by. A signal from space must somehow survive attenuation over thousands of millions of miles. And it must also survive the competition of noise produced by the random emissivity of many warm bodies - not only components of the communication system itself but also the earth, nearby machines, and the many celestial bodies within view of the antennas.

"Up to now our approach to gaining an advantage for signal power over noise has been the traditional one for radiated-wave communication systems; that is, increasing the power of transmitters, the sensitivity of receivers, and the gain of antennas. Howeve: ground antennas and receivers are reaching their theoretical performance limit, and in spite of our ability to mount ever larger payloads, and thus more powerful transmitters and antennas on our spac craft, we are beginning to see an end to the improvements such components can provide (see 'Deep Space Communication,' July'64, p. 54). An increase in spacecraft transmitter power from the prese: 20-25 watts to a possible 100 watts, and an increase in spacecraft antenna gain from 36 db to 40 db - these are the most optimistic expectations. And these, bought at the expense of severe weight and volume penalties, will increase information rate at most about ten times.

Information rate varies as bandwidth

"In contrast, the recent introduction of digital methods into space communications has set the stage for the exploitation of coding and data compression techniques which promise eventually to increa: data rates by up to two or three orders of magnitude. It is such techniques that will be required by the missions of the seventies."

DETECTING ELECTROLYTIC CORROSION

The Bureau of Ships Journal, Feburary 1965, carried the above item which is reproduced in full but without the drawings.

"A device for detecting and demonstrating electrolytic corrosion has been suggested by E. B. Young, EM1, of USS Isle Royale (AD-29). The device consists of an altered Roller-Smith Steel-Six series ammeter. The movement is set to zero at center scale, and the internal shunt and calibration resistor are removed, as shown in the accompanying drawing. When recalibrated, the meter reads 9 millivolts full deflection.

"The altered meter will detect the small potential differences generated when incorrect metals and alloys are used in sea water piping systems. By measuring the potential differences of piping system components, the causative factors of an electrolytic corrosion process can be quickly isolated.

"The device is an excellent training aid. By connecting the meter to samples of various metals and alloys and immersing them in sea water, an instructor can demonstrate electrolytic action. This demonstration graphically illustrates the abstract concept of electrolysis.

"Many engineering personnel replace and repair corroded parts without understanding the importance of using correct metals and alloys in the new parts. The meter, used as a tool and trainin aid, can help eliminate this problem."

THE TECHNIQUES OF CONTACT PROTECTION

In the February 1965 issue of Electrical Design News is one of two articles with the above title authored by F. W. Parrish, Asst. to the Vice President, Engineering, International Rectifier Corp., ElSegundo Calif. The second article is titled "Techniques of Semiconductor Arc Suppression." The subtitle to the first article is as follows:

"The techniques available to prevent spark damage to relay and switch contacts often are overlooked or misunderstood. Introductory to the practical application of spark suppressors, a few comments will help to clarify and define the problem."

The sub-title to the second article is as follows:

"The use of semiconductor devices has been one of the most successful methods of minimizing contact arcing. Selenium rectifier cells have been used for more than 20 yr. As newer semiconductors have been developed and perfected, each has been adapted to the type of circuit for which it is best suited. A comparative tabulation showing circuits, effects, advantages and disadvantages is presented in Figs. 1 through 4."

DOUBLE INSULATION FOR PORTABLE TOOLS - SAFE OR LETHAL?

David N. Summerfield, Chief Engineer, Skil Corp., Chicago 30. Ill., authored an article under the above title in the February 1965 issue of Insulation. The section Electric Shock - General is as follows:

"For an electric shock to occur, a person must simultaneously touch two electrically conductive objects which are at different voltage levels. One of these objects is usually the earth or a metallic object which has been grounded. The other object could be either a live wire or a metal object separated from a live wire by insulation, where the insulation has failed or deteriorated sufficiently to allow leakage currents to flow. Currents of different magnitudes produce different effects on humans, as shown in the following table:

Current	Effects
1 milliampere (0.001 ampere)	Sensation
3-5 milliamperes	Sharp pain - jump
9-22 milliamperes	Severe muscle contraction which one can voluntarily release without injury
10-24 milliamperes	Contraction so great that one freezes to the circuit
30-50 milliamperes	Unconsciousness without affecting either heart or lungs
0.1 to 2 or 3 amperes	Ventricular fibrillation of heart
6 plus amperes	Paralysis of respiration

"The voltage required for a shock severe enough to cause recoil is much lower than generally realized. Bassett, Gurney, and Martin have described a demonstration designed to pass 6 milliamperes (enough to cause sharp pain and recoil) from hand-to-hand as requiring about 20 volts with dry hands, and about 9 to 14 volts with wet hands. This tends to discredit the concept of 40-volt electric tools, which are acceptable in some parts of the world in lieu of grounded or double insulated types.

"The duration of an electric shock can be much shorter than generally assumed, and still be lethal. Kouwenhoven states, 'Commercial frequency a-c shocks of as short as 1/120 second may result in death if they fail in the vulnerable part of the heart cycle - approximately one-tenth of the complete heart cycle.' "

TEMPERATURE NEEDS IMPORTANT IN SHIELDING SPECIFICATION

In the February 15, 1965 issue of Electronic Design, John J. Malneritch, Vice President and General Manager, Amphenol Space & Missile Systems, Chatsworth, Calif., authored an article titled "Four Factors Influence Harness Design." The subtitle and a paragraph on temperature are as follows:

"Meeting the electrical requirements of a system is only half a solution to a cable harness design problem. For high-reliability, environmental needs must also be satisfied.

"Shielding is generally well understood. Copper wire strands, braided around the insulation, provide good protection and flexibility with 85 to 95 per cent coverage. Temperature requirements must be considered in the braid specification, however. Since the insulation's coefficient of expansion may exceed that of the braiding, a too-tightly wrapped braid could cause an insulation blow-out."

REMOTE SWITCHING TECHNIQUE REDUCES SYSTEM NOISE

In the February 15, 1965 issue of Electronic Design in the section "Ideas for Design," there is an idea by Michael I. Neidich, electronic engineer, Sanders Assocociates, Plainview, N. Y., under the above title. The article has two schematics and the following are the first two sentences:

"A relay and unity-gain transistor amplifier permits the remote selection of either an ac signal or one that is 180 degrees phase-inverted. The relay arrangement obviates the need for bringing long signal leads to front panel switches and in this manner minimizes system noise."

BROAD-BAND UHF NOISE TUBE GENERATES 250 WATTS CW

Microwaves, February 1965, has a 3-column description of a new noise tube. The two paragraphs are as follows:

"High-power, simultaneous noise across a 450 to 900 Mc band is generated by a crossed-field noise tube from S-F-D Laboratories, a subsidiary of Varian Associates, Union, N. J. (Tel. 201-687-0250). The SFD-501 delivers 250 w integrated power across the entire band, which is more than 140 db above thermal noise. Its overall efficiency exceeds 30 per cent. No mechanical or voltage tuning is necessary.

"The tube closely resembles a wide-band crossed-field amplifier. Noise is generated primarily as a chaotic tumbling of space charge between cathode and anode. Even without subsequent amplification the noise thus obtained is well above thermal levels, reaching tens of mw/Mc."

AUTOMATIC BROAD & NARROW-BAND SIGNAL READOUT AND RECOGNITION

White Electromagnetics, Inc., 670 Lofstrand Lane, Rockville, Md., has brought out a Technical Bulletin, Vol. 5, No. 2, under the above title. Copies may be obtained by writing to WEI at the above address.

AD NUMBERS OF TRI-SERVICE CONFERENCE PROCEEDINGS

The following Proceedings of the Radio Interference Reduction and Electromagnetic Compatibility Conference may be obtained from the Clearinghouse for Federal Scientific and Technical Information, Dept. of Commerce, Sills Bldg., No. 5285, Port Royal Rd., Springfield, Va. at cost of reproduction:

1st	Conference	AD-76-686
3rd	"	AD-234-211
4th	"	AD-234-212
5th	"	AD-235-099
6th	"	AD-253-015
7th	"	AD-276-205
8th	"	AD-298-763

The Proceedings of the 9th Conference is not yet available and the Proceedings of the Second Conference is out of print.

ELECTROPLATED CLOSURE MAKES EXPLOSIVES BEHAVE

In the March 1965 issue of Materials in Design Engineering, the following item starts on page 161 under the above title:

"Small explosive charges, such as those used in explosive forming devices, can be hermetically sealed by electroplating. Electroplating puts an enclosure around the explosive charge after it has been fabricated, as compared to the usual method of making a case of inert material into which an explosive is pressed or cast.

"Other advantages of electroplating, besides hermetic sealing, are: 1) unusual explosive shapes can be encased; 2) the electroplate provides a rugged enclosure; 3) selectively controlled thickness of the electroplate can be used to control the hydrodynamic behavior of the explosive; 4) a broad choice of confining metal can be used; and 5) the confinement of the explosive can be used to modify the behavior of an explosive charge that has been manufactured by conventional techniques.

"Here's how the plating technique works. The charge to be plated is provided with a conductive coating and, as shown, is placed behind a barricade while a remotely-operated plating bath is raised around the piece by an adjustable, height-leveling reservoir. A magnetic stirrer agitates the bath to remove gas bubbles and maintain uniform ion concentration. Simple d.c. power supplies provide currents ranging from 5 amp for large plating applications to a few milliamperes for small jobs.

"The explosive charge to be plated is protected from wetting by the plating solution with three coats of a clear, waterproof lacquer. The lacquer also forms a smooth surface for plating. Since it would be unwise to pass a current through the explosive charge, a conductive coating is painted over the lacquer to promote electroplating and to prevent a current from passing through the explosive charge. As soon as a thin deposit of the plating metal forms on the conductive paint, the current is carried mostly by the electroplate itself."

It is suggested that the readers, before attempting this process, get in touch with the U. S. Naval Ordnance Laboratory, White Oak, Md., who originated this idea, and get further details.

ELECTROPLATING EXPLOSIVE DEVICES

Explosion Dynamics Division, Explosions Research Dept. U. S. Naval Ordnance Laboratory, White Oak, Md., has brought out a 34-page unclassified report under the above heading. The abstract states:

"Abstract: Techniques for electroplating explosive items are described. Electroplating was used to encase mild detonating fuse terminating detonators, and small pressed charges, both flat-ended and shaped. Conventional lead-sheathed flexible linear shaped charge showed improved performance when plated with a thin sheath of silver. Underwater charges were sealed and confined by electroplating with copper. Fabrication and testing data for the above items plus other suggested applications are given."

Requests for additional copies by Agencies of the Dept. of Defense, their contractors, and other Government agencies should be directed to:

Defense Documentation Center (DDC)
Cameron Station
Alexandria, Virginia

Department of Defense contractors who have established DDC services or have their 'need-to-know' certified by the cognizant military agency of their project or contract should also request copies from DDC.

All other persons and organizations should apply to:

U.S. Department of Commerce
Office of Technical Services
Washington 25, D. C.

"GETTING CLOSER TO GOD"

CB Magazine, April 1965, contained the following letter to the editor

"Dear Sir:

"While attending church in my home town, I was very attentatively listening to the sermon entitled 'Getting Closer To God', when suddenly the sanctuary loudspeaker crackled: 'Why, hello there Ol' Buddy!' When awe, which had suddenly turned to laughter, had subsided, the priest returned to his text with the admonition 'man must know God to reach heaven.'

" 'I'll be up to see you one of these days' the loudspeaker volunteered.

"Church officials later traced the trouble to one of those electronic quirks where normally disciplined appliances suddenly intercept short wave messages.

"That seemed to satisfy the officials, but unless my red face gave it away, I alone knew the invisiable owner of the voice to be my husband talking to a friend on his CB radio while waiting to drive me home from church!"

GARAGE DOOR CAN CAUSE A MODEL-PLANE CRASH

The Baltimore Sun, April 14, 1965, carried the followed news item in part:

"Washington, April 13 (Special) - The plane climbed into a steep stall, faltered, plunged into a tailspin and crashed to earth as the crowd watched.

"Tragedy? Fortunately not, because this was a radio-controlled model. But the primary cause for such accidents has model airplane enthusiasts boiling mad and deeply involved with the Federal Communications Commission.

"The problem is that the radio frequency assigned for use of the model airplane pilots is shared by others with different radio objectives. As a result, a man pushing a switch to operate his automatic garage door or cutting in his two-way car radio may interrupt the radio beam to the model plane and send it out of control.

"No Joke"

"As put by Dr. Walter A. Good, of Bethesda, Md., a spokesman for the Academy of Model Aeronautics, 'this is no joke when you consider that some of these models are very complicated, have a 5-foot wing span and cost up to $500 or more.'"

DESIGNING THE RFI SHIELDED PACKAGE

Arnold L. Albin, Manager RFI Compatibility Section of Fairchild Space & Defense Systems, 300 Robbins Lane, Syosset, L. I., New York, informs the Newsletter editor that reprints are now available from him of the above article which appeared in the January 1965 issue of Electronic Industries.

RADIO FREQUENCY INTERFERENCE CONTROL

Westinghouse Defense Center, Electronics Division, P. O. Box 1897, Baltimore 3, Md., has brought out a 6-page brochure under the above title. It describes the test facilities available at Westinghouse and the work which they are doing on interference problems. Copies may be obtained from George W. Nisson, Mgr., Marketing Communications.

NEW PROBLEMS IN INTERFERENCE

Raymond F. Elsner and James J. Krstansky, of IITRI, have written a 5-page article under the above title for the Autumn 1964 issue of Frontier, the quarterly published by IIT Research Institute, 10 West 35th Street, Chicago 16, Illinois. The subtitle and first paragraph are as follows:

"In any facility where transmitters and receivers are crowded together, spurious frequencies can be generated by metal parts within the environment. In the accompanying illustration, black lines represent original transmissions, red lines depict possible interfering frequencies.

"With the advent of complex communications facilities severely crowded into narrowly confined areas, such as on shipboard or on aircraft, an old problem in electromagnetic interference has suddenly taken on new importance. TV and radio repairmen know the phenomenon as 'singing stovepipes' - the strange reception of signals by ordinary pieces of metal. The technical nomenclature for this feat is environment-generated intermodulation interference. It is a particularly difficult interference problem to solve because intermodulation products (spurious frequencies) can be caused by rusty bolts, faulty welds, or mechanically loose connections found within the strong radiated fields near transmitting equipment."

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE CHIEF ENGINEER
WASHINGTON 54, D. C. - OCE BULLETIN NO. 10
Revised April 1965

ATTACHMENTS TO TYPE APPROVED EQUIPMENT ILLEGAL

Owners and operators of equipment type approved under Parts 15 or 18 are cautioned against using such equipment with auxiliary devices that are not covered by the type approval.

Before attaching such auxiliary devices, the user should assure himself that the combination was tested and found to comply with the FCC regulations. Examples of such auxiliary devices that may NOT be attached without prior approval:

- a low voltage stimulator to a type approved medical diathermy or ultrasonic equipment.
- a different tank to a type approved ultrasonic cleaner.
- a microphone on an extension cable to the transmitter part of a type approved wireless microphone.

Experience has shown that the connection of additional cables changes the radiating characteristics of radio frequency generating equipment. In general, the connection of such additional cables can be expected to increase the radiation since these cables tend to act as radiating antennas. Tests at the Commission's Laboratory have definitely established that in many instances, the connection of a second piece of equipment to a piece of type approved equipment will increase the radiation of radio frequency energy from the type approved equipment The operation of type approved equipment with increased radiation is a violation of Part 18 of the Commission's Rules and is illegal. Furthermore, such operation invalidates the certificate of type approval.

Accordingly, before any auxiliary equipment is connected to a type approved piece of medical equipment for simultaneous treatment of a patient with two forms of therapy, the combination must be tested to establish that the type approved equipment will continue to comply with FCC regulations.

Similarly, before an extension cable is used with a type approved wireless microphone, or before two or three microphones are connected through a mixer to a type approved wireless microphone, the combination must be tested to establish that the type approved wireless microphone will continue to comply with FCC requirements.

On the request from the manufacturer, the Commission will retest type approved equipment which is intended to be operated with auxiliary devices attached thereto. A request for retesting may be submitted as follows:

- for medical diathermy equipment with attachment § 18. 144
- for ultrasonic equipment with attachment § 18. 82
- for wireless microphones with attachments § 15. 235

If the combination is found to comply with FCC regulations, an amended type approval will be issued, specifying the auxiliary devices that may be attached and the manner in which the connection must be made.

Since Medical diathermy and ultrasonic equipments may be certificated by the user, he may, if he desires, test the combination in the manner prescribed for certification and prepare an appropriate certificate attesting that the combination complies with the applicable FCC requirements. For ultrasonic equipment, measurements must follow the procedure in § 18. 78 and the certificate must conform with the provisions of § 18. 80. For medical diathermy equipment, measurements must be made in accordance with the provisions of § 18. 143 and the certificate must conform with § 18. 141 or § 18. 142 depending on the operating frequency of the equipment. In each case, the type approval number on the medical diathermy equipment or on the ultrasonic equipment MUST BE OBLITERATED, since the combination as such, is no longer type approved.

No certification procedure has been provided for wireless microphones in the band 88-108 Mc/s. Accordingly Commission approval must be obtained before an auxiliary device may be attached to a type approved wireless microphone in this band.

Parts 15 and 18 are contained in Volume II of the FCC Rules and Regulations which may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 2, D. C. at a cost of $2. 00. Purchase price includes the basic volume plus all amendments which are mailed to the purchaser when issued.

-FCC-

NEW PRODUCTS

New Filtron Catalog Available

A new catalog No. P-64 to announce the new Powerline Series R. F. Interference Filters for Electromagnetic Compatibility is now available through the Marketing Dept. of Filtron Co., Inc., 131-15 Fowler Ave., Flushing 55, N. Y. The catalog also contains supplementary information on: How to determine filter requirements for any circuit; installation recommendations, and architects' and engineers' specifications for shielded enclosures.

Another new product on which information is available is the Filtron ATTENU-DUCT Shielded Wiring Raceways for blocking radiation from unfiltered power lines to provide an interference-free environment. Where security is important, the shielded raceways secure telephone, teletype, control, computer and other data communication lines. Architects' and engineers' specifications are also available for this product.

Hallett Ignition Noise Signal Saver

The Hallett Mfg. Co., 5910 Bowcroft St., Los Angeles 16, Calif. has brought out a folder No. 1-65 on the Hallett Alternator/Generator-Regulator Shielding Systems. Hallett 25000 and 27000 series signal saver shielded ignition systems are available titled "Nothing But Noise" by Robert McIntosh, President of the Hallett Mfg. Co. This booklet goes into all aspects of interference from ignition systems.

New EMI/RFI Shielding Tape

Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J., has brought out a new EMC shielding tape which is multi-strand knitted from 37 gauge tin-coated, cooper-clad steel wire for the shielding of cable harnesses and cable splices against electromagnetic or radio frequency interference. A shield may be wrapped over a splice with the ends of the tape soldered to the cut ends of the cable braid. The wrapped cable harnesses covered with this knitted tape are extremely flexible when compared to those covered with conventional braid.

Electronic Slide Rule with Instruction Course

Cleveland Institute of Electronics, 1778 East 17th St., Cleveland 14, Ohio, has brought out a slide rule specifically designed for the exacting requirements of electronics computations. It comes with an illustrated Instruction Course consisting of four AUTO-PROGRAMMED lessons. This all-metal slide rule comes in a leather carrying case priced at $14. 95.
