# EMC SOCIETY of AUSTRALIA NEWSLETTER

The official newsletter of the Electromagnetic Compatibility Society of Australia
IEAust 11 National Circuit Barton ACT 2600

A SOCIETY OF THE INSTITUTION OF ENGINEERS AUSTRALIA

**Issue Number 3** **AUGUST 1998**


## *MESSAGE FROM THE CHAIRMAN*

1 January 1999 is looming and it will be a significant date for many people. The 'Euro' will become the common European currency and it is anticipated that it will have a huge impact on the world. Closer to home however all products offered for sale in the Australian residential, commercial and light industrial environments are required to comply with the EMC Framework.

Many product managers and designers have had to do a lot of work on their products in a relatively short period of time to ensure product compliance with the EMC Framework.

In the longer term there will be many more compliant products in the market place, which will make life a lot easier for equipment purchasers. Also, one of the major benefits of the EMC Framework post 1 January 1999 is that non complying imported or locally manufactured products will not be (or should not be) in the market place. Also EMC will, over time become an integrated part of the design process rather than an unnecessary adjunct imposed by some miscellaneous specification.

The EMC Community has an obligation to 'spread the word' as effectively as possible especially to those manufacturers who may not be main stream electrical/electronic manufacturers. An example of this includes manufacturers who have products which are essentially mechanical but have a microprocessor controller – EMC compliance is still a requirement.

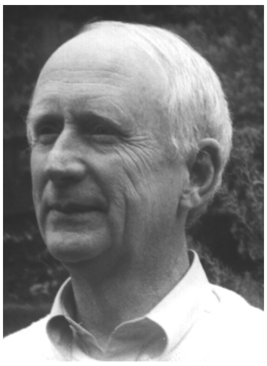
On other issues worldwide growth projection in the personal communications market will see EMC remain an important issue. I believe that in the years ahead we will be thankful to the regulators and standards people for much of the work done on EMC over the last few years.

A very well attended first technical presentation for the EMC Society was most ably presented on visualisation and electromagnetics by Alan Nott of the Army Technology Engineering Agency. Many thanks to Alan.

The second presentation will be by Michael Bangay of the Australian Radiation Laboratory on RF radiation, health effects, ACA frameworks and the new exposure standards. The presentation will be on 8 September, 6.00pm at the IEAust auditorium at 21 Bedford Street North Melbourne. See you there.

John H Pluck FIEAust, SMIREE, CPEng

## *MEDIA SPOKESPERSON*



The EMC society has appointed Mr. John Hyne as its media spokesperson. John, a member of the committee and a member of the Institution of Engineers Australia has good credentials to speak on behalf of the society on EMC matters. He has been associated or engaged in EMC engineering for some 30 years having worked in government, private industry and tertiary education. He is the author of a number of papers and has written four handbooks on EMC related subjects.

John is currently employed by Tenix Defence Systems, Melbourne, as a Senior Systems Engineer in Communications. He may be contacted at:

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# ANTENNA CALIBRATION SITE OF BAPT IN ITZEHOE

The German Post and Telecommunications Office (BAPT) in Mainz is a government authority responsible for, among other things, radio monitoring and radio interference suppression. The Radio Monitoring and Inspection Service (PMD) with 53 branch offices all over Germany is equipped with state-of-the-art test and measurement equipment. Maintenance, repair and calibration of this T&M equipment are mainly carried out in BAPT work-shops and calibration centres. Regular calibration ensures high precision of results including the required traceability to recognised methods and standards.

Since March 1997 the BAPT office in Itzehoe (Schleswig-Holstein) has been using a new test system for highly precise antenna calibration to CISPR 16-1 and DKE 767.4.2/ Ant-Cal. No. 31-93 (dated 19 July 1993) in the frequency range 30 to 1000 MHz. This is the first standard-conformant test equipment of its kind in Germany. Acceptance carried out by the internationally accredited research and test institute Seibersdorf near Vienna was successfully concluded and, in autumn 1997, the calibration system was additionally accredited by the German Standards Laboratory (PTB) in Braunschweig.

Fig. 1 Open area antenna test site of BAPT in Itzhoe with its two 8 m high antenna rigs

Photo 42 965/1

The system was evolved from an existing Calibration System for Test Equipment TS9099 from Rohde & Schwarz. The core of this enhanced system is an open area site (test distance 10 m) on a reinforced concrete platform 20 m x 17 m in size. The site has an unobstructed overall area in the form of an ellipse with axes of 100 m x 85 m (FIG 1). It is constructed so that not only mobile antennas but also antennas on test vehicles can be calibrated. The maximum permissible load on the test platform is 7.5 t. The conducting reference plane consists of a metal groundplane made of a weatherproof V2A grid with mesh width of 2 cm x 2 cm. This groundplane is spring-loaded, maximum unevenness amounting to only 5 mm. The site is provided with two 8 m high antenna rigs in the form of double masts, both fitted with elevators for vertical positioning of antennas. In addition, the receiving mast can be rotated horizontally through $360^0$ in steps of $2^0$. All antennas are positioned by electro- mechanical drives accommodated in the pit below the antenna rigs. During non-operational phases the rigs, because of their height, are secured by wires.

The open area site is linked to the test system, about 100 m away (FIG 2), by power supply, signalling and control cables in underground conduits. Low attenuation Flexwell cables are used for signal transmission and optical cables for system control. To avoid AC power line effects on measurement results, shielded cables are used for the power supply. The site is safeguarded against lightning strikes by a grounding ring with the same potential as the test system in the building.

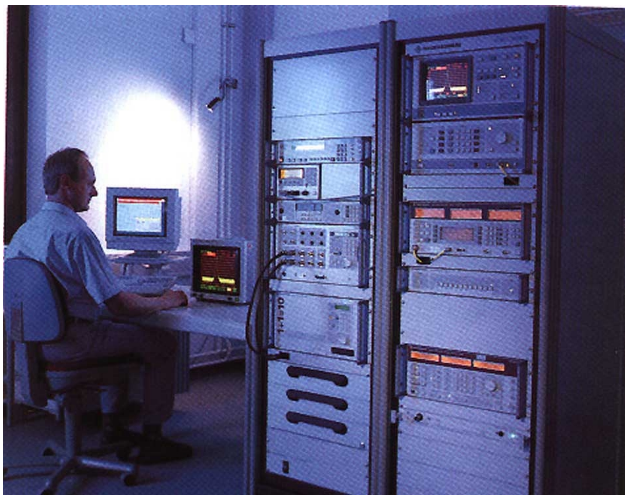


FIG 2 Germany's first standard-conformant antenna calibration system at BAPT in Itzehoe

Photo 42 965/10

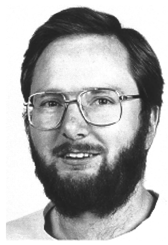
The calibration system for test equipment is complemented by an antenna controller with software for positioning antennas as required. On-site tests and measurements are monitored by special video equipment that covers every point of the active test area and provides special zoom facilities for high-resolution display of details on the monitor in the test room. Special calibration software was implemented to measure VSWR, antenna gain, radiation pattern and antenna factor. All tests are automatically controlled by Calibration System TS9099 and results are output as calibration reports. Rohde & Schwarz, as the main contractor, planned the automatic open area antenna calibration site, supervised its construction and handed over the turnkey system to BAPT on schedule. The test site is the first of its kind in Germany.

Alexander Klein (BAPT Mainz)

Reprinted courtesy of Rhode & Schwarz.

# COMPUTER AIDED EMC ANTENNA DESIGN

Professor Andy Marvin & Dr Stuart Porter



**Introduction.**

EMC antennas are required to perform two types of measurement, radiated emissions and radiated immunity. It is usual and convenient if the same antenna can be used for both types of measurement.

For emission measurements the antennas are placed at defined distances from the Equipment-under-Test (EUT), normally 1m (military only), 3m, 10m or 30m with 3m and 10m being the most common. The measurement is made on an open-area test site or in a screened enclosure with some degree of anechoic provision. These are very different environments from that for which the antenna may have been designed. The antenna is required to provide a measurement of the electric field radiated by the EUT at that distance. The antenna parameter that describes this aspect of the antenna's performance is the Antenna Factor which relates the input voltage measured at the receiver (microVolts or dB:V) to the incident electric field (:V/m or dB:V/m) and thus has the units of 1/m or dB/m. The antenna factor can be related to more well understood antenna parameters such as gain but only under properly defined conditions.

For immunity measurements the antenna is operated in a screened enclosure with some anechoic provision at a distance of 3m from the EUT. The antenna is required to illuminate the EUT with a defined electric field strength having a defined field uniformity over a plane area at the front face of the EUT. Again, this is a very different operating environment than that for which the antenna was originally designed. In this case the antenna parameter of interest is the gain which can be used to calculate the field at the EUT through a calculation of the radiated power density at the EUT position. A more useful measure is the power required from the transmitter to achieve the required field strength with the specified modulation depth.

The common factor in both types of measurement is that the antenna to EUT spacing is small, typically 3m. There are two consequences of this. The first is that the lowest frequency of operation is defined by the requirement for the antenna to EUT spacing to be more than about a sixth of a wavelength in order for the radiation condition to be established. The second is that the antenna must illuminate the EUT with a uniform field and cannot therefore be too directive. In fact, if a very directive antenna is used, the Rayliegh range criterion indicates that the antenna to EUT spacing must be increased. The advantage that the increased directivity and hence gain gives in field strength for a given input power is not realised because of the increased antenna to EUT distance. The test facility must also be bigger.

**Design Considerations for Emissions and Immunity Antennas.**

The observations above have led us to develop our own design criteria for EMC antennas. The design process uses a Boundary Element computer code with a Method of Moments matrix inversion algorithm. The use of such codes is limited by the fidelity of the results which, in part, is determined by the skills and experience of the operators. Problem segmentation , i.e. dividing the modelled antenna structure into a series of wire elements, can only be done effectively by an experienced user. We have developed some automatic segmentation routines for the more regular geometric aspects of the antenna structure, however there is always a need to fine tune some of the segmentation in parts of the structure.

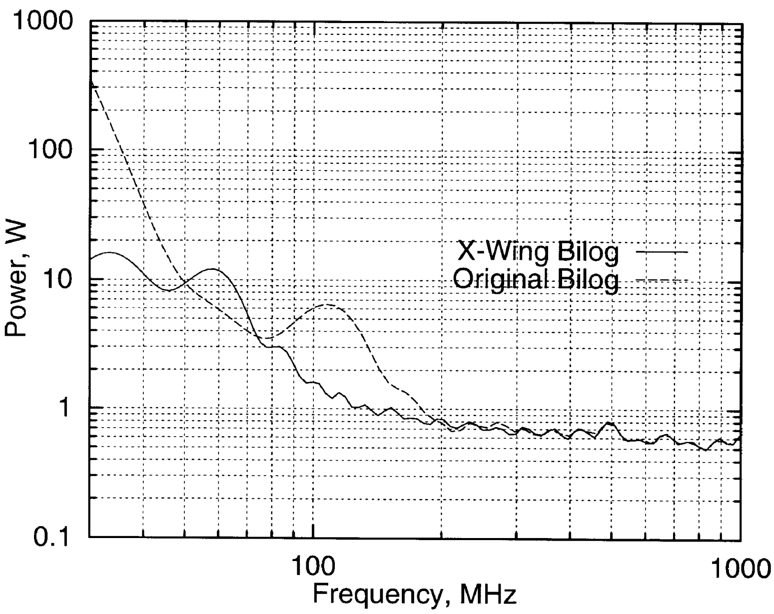



**Figure 1**

The computer code has various excitation modes. For radiated emission antenna design we evaluate the free space antenna factor by exciting the antenna structure with an incident 1V/m plane wave and computing the voltage across a 50Σ load resistor at the antenna output. Plots of antenna factor against frequency are produced in post processing routines. Groundplane effects can be modelled if necessary although the manufactured antennas are calibrated



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for their free space antenna factors. The directional properties of the antenna can also be modelled in this mode. Fig 1 shows a typical prediction of the Antenna Factor of a Bilog antenna compared with the measured values and indicates the agreement with measurements that can be obtained by careful use of numerical electromagnetic techniques.

For immunity antenna designs, the code is set up to mimic the test environment. Radiated immunity measurements require the antenna to illuminate a plane surface of dimensions 1.5m by 1.5m at a distance of 3m from the antenna reference point. The field must be measured at sixteen points on a regular square grid with 0.5m spacing. Twelve of the sixteen points must achieve the target field with a field variability of -0dB to +6dB.

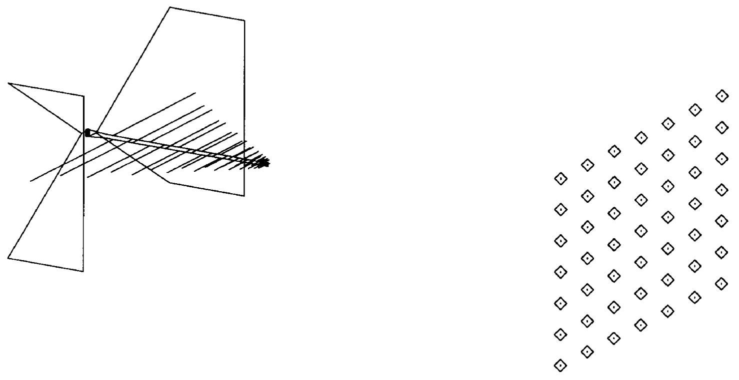

**Figure 2**

In the immunity case we evaluate the radiated field from our antenna at each frequency on a regular square grid of the required dimensions with 0.25m spacing, i.e. a 49 point grid. The antenna is driven by a 1V source with a 50Σ internal impedance. Post processing of the results is used to compute the source voltage required to achieve a target field strength, 3V/m or 10V/m, at the point in the grid that gives the minimum field at the particular frequency. The field variation across the grid is computed to check that the 6dB field variation is not exceeded. The required source voltage is used to compute the power that this source would drive into a 50Σ load. We then plot this result as the amplifier power needed to achieve the required field strength. Fig 2 shows an example of the pre-processing used. Here an X-Wing Bilog is shown in front of the 49 point grid. The results can be scaled to give amplifier powers for any field strength and the linear amplifier power required for 80% amplitude modulation (AM). This later requirement is a major driving factor in EMC antenna design as the power required of a linear amplifier is $(1.8)^2$ or 3.25 times as great to give a defined field strength with 80% AM applied as it is to give the unmodulated field strength. Much of our recent effort has been devoted to reducing the power requirements of our designs from 80MHz to 1GHz while maintaining good receiving performance down to 30MHz. Fig 3 shows the predicted power requirement of the X Wing compared to a standard Bilog for a 3V/m field 3m in front of the antenna apex with 80% AM.

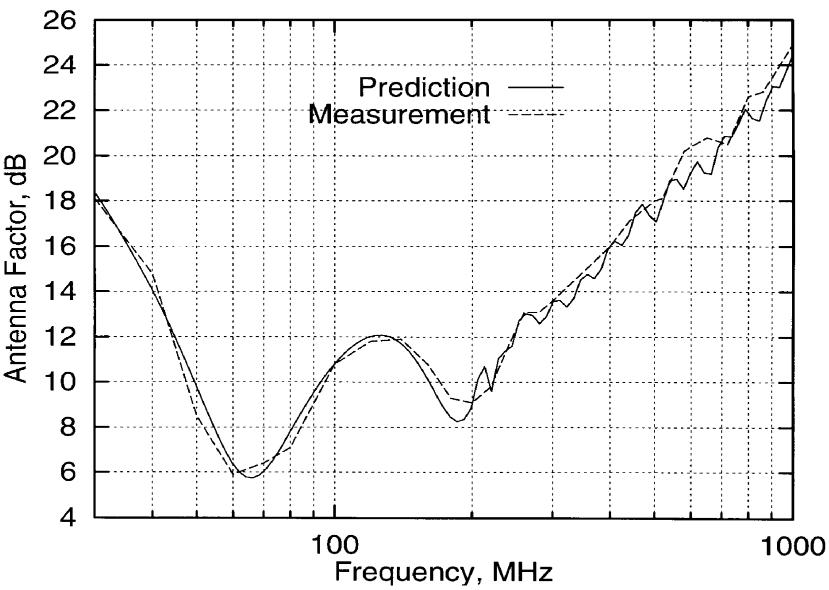


**Figure 3**

**Concluding Remarks.**

Our antenna design efforts have led to the Bilog series of antennas produced by Schaffner Chase EMC and imitated by many others. These were the first antennas to efficiently cover the full 30MHz to 1GHz frequency range in a single structure and the X Wing derivative now covers 20MHz to 2GHz for immunity measurements. We are continuing our efforts with further design improvements and are now investigating the use of Genetic Algorithms in the optimisation of the designs for particular applications.

Contact the authors for information on our Computational Electromagnetics design, consultancy and education activities or see them on http://emc2.ohm.york.ac.uk/

Professor A.C.Marvin, M.Eng, PhD (Sheffield), CEng, MIEE, MIEEE.

Professor Marvin had several years of research experience both as a graduate and a Research Fellow. He was appointed Lecturer in 1979, Senior Lecturer in 1986 and Professor in 1995 at the University of York. He holds executive offices in several expert EMC groups and is Associate Editor for IEEE Trans EMC.

Doctor Stuart J Porter, BSc, D.Phil, MIEEE.

Dr. Stuart has had several years research experience, a year as a Teaching Fellow and a year as a Research Fellow. He was appointed Lecturer at the University of York in 1993.

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**Apology**: In the last newsletter we accidentally referred to the Australian Competent Bodies Association as an Authority instead of an Association.

# THE QUEST FOR THE IDEAL RF AMPLIFIER.

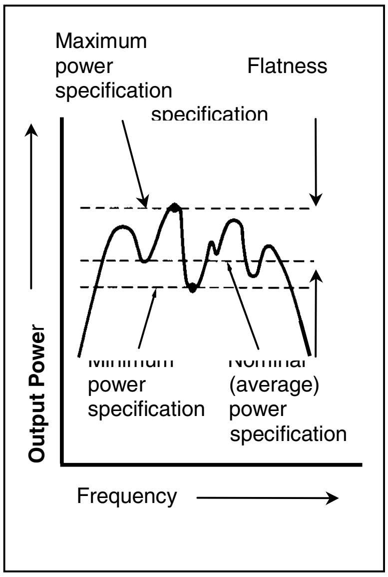
The basic function of a power amplifier is always the same: to boost a low-power signal to a higher power level, to be delivered to the amplifier load. Because that role is so fundamental, it's tempting to view amplifiers as simple black-box devices, with an input, an output, and a constant amplification factor. In many instances, the black-box approach provides an adequate picture.
It fails, however, when the demands placed on an amplifier are extreme. Hardest to satisfy is the requirement for maximum capability of two or more conflicting parameters, such as the demand for broad bandwidth and high power in the same package.

**Bandwidth versus power -** The demand for broadband, high-power capability has spawned a bewildering variety of amplifiers. Part of the problem is in the bandwidth limitations of power devices themselves. In any device, gain falls off at higher frequencies, largely as a function of internal parasitic capacitance. Eventually a frequency is reached where gain falls below unity, and the device stops functioning as an amplifier. To extend the bandwidth, the designer must sacrifice the size - and, with it, the power-handling capability.
Considerable effort has gone into development of output devices capable of high-frequency operation and power handling, but the conflict between these parameters has never been fully resolved. The amplifier designer faces a clear limit in the gain-bandwidth product and power capabilities of the devices, and the necessity for tradeoff and compromise in the circuit.
Along with device limitations, the designer must contend with another aspect of the broadband/high-power dilemma - the tendency for high-gain, untuned amplifiers to break into oscillation. This is of considerable importance in broadband amplifiers, where design calls for stable operation over a bandwidth often of several decades. Combined with this is the frequent requirement that the amplifier be stable under conditions of severe mismatch in the load.
Designing for broad bandwidth and stable operation within device limitations is the designer's real job - and headache. But it is exactly in this area where the designer makes a major difference in amplifier performance, Here is an opportunity to create a circuit that gets the maximum out of available devices, and a good chance to keep advancing the state of the art.

**Approximately perfect** - The ideal black-box device would deliver rated power - with no variation in level - over its entire bandwidth. Good designing can approximate this ideal; the degree to which a designer must compromise amplifier performance determines the capabilities and limitations of the amplifier. He defines these by stating the amplifier's specifications. It is here, ultimately, that the person purchasing and using the amplifier must be knowledgeable.
With a basic understanding of the parameters that have to be traded off in designing an amplifier, and an understanding of what the specifications mean and how they are stated, the user can select an amplifier with confidence that it will do the job it's intended for.

## How broadband high-power amplifiers are rated.

**The power rating** - High-power rf amplifiers are usually rated for cw (continuous-wave) operation. Pulse power (see box on this page) is not an accurate indication of an amplifier's capability, simply because of the variables involved. Rating for cw operation gives the user an understandable figure on which to base his judgment - if, that is, the methods of rating are known.
A simple statement of the power output of an amplifier, expressed in watts or dBm, is not enough to describe the amplifier's capability. Output power varies with frequency in any amplifier. The degree to which it varies allows a certain flexibility in specifying output. For this reason, the user should know how the given figure was chosen, and the tolerances within which it fits.
Stated power can represent *maximum* power at a specific frequency, *nominal* power over the amplifier bandwidth, or *minimum* power available at any frequency within the bandwidth. The graph illustrates the differences that can exist in power claims for a given amplifier.




Clearly, the way the designer rates his amplifier makes a difference. This depends to some extent on the intended use; certain ratings make more sense than others in particular applications. A minimum power rating guarantees availability of at least the full rated output over the entire bandwidth. This is the most desirable rating for the bulk of high-power rf applications, because it allows for headroom above a consistently predictable figure. Excess power capability is rarely a complaint.
In some special cases it's more meaningful to specify *nominal* power. Frequency tuning of apparatus, for example, calls for "ballpark" power from the amplifier. In this application, the ballpark is the flatness specification, and the quality of the flatness specification is as important as, or more important than, the absolute power being delivered to the load.
Knowing the nominal power rating and the flatness specification, the user can still safely assume a minimum figure for output. Amplifiers rated in this way will always deliver power greater than the rated power minus the total flatness specification.
While it's possible to calculate minimum power if both a maximum power rating and a flatness specification are given, maximum ratings tend to be deceptive figures. They sound good; they also carry the implicit admission that, over most of the

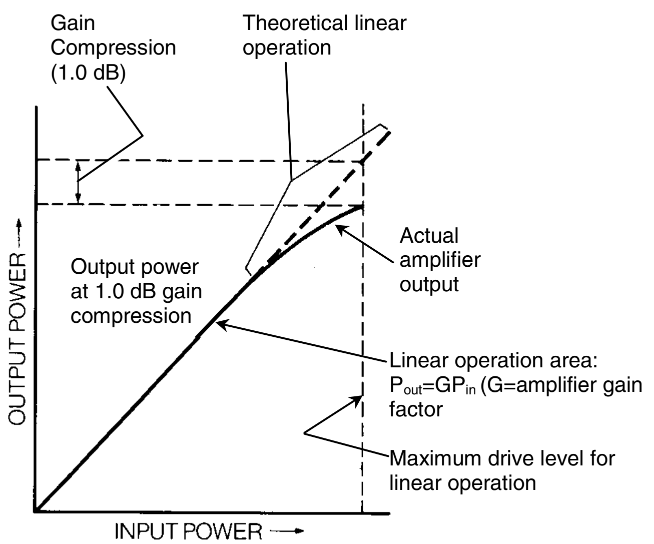
bandwidth, the actual output will be less than rated output. If no flatness specification is given, minimum performance remains entirely undefined.
Amplifier Research rates most of its amplifiers by minimum power, so the user can always predict minimum performance. Ratings are also given with a flatness specification, usually ±1.5 dB; conservative ratings overall give the user an extra margin of flexibility.
One more consideration regarding output power: the drive level required to obtain rated output. This can vary widely; in the worst case, the user can find himself unable to get full use from an amplifier simply because he can't provide enough signal. All AR amplifiers are designed to require a maximum of 1 mW input for full rated output. They will withstand twenty times rated input without damage.

**The amplifier bandwidth** - The upper and lower frequency limits of an amplifier are defined - in Amplifier Research specifications - as the frequencies where the rated output falls below the value of the minimum power specification, or below the range of the flatness specification.
Amplifier manufacturers don't always spell out the methods they use to determine bandwidth; some amplifiers, for instance, may be rated at the "3 dB down" points. These are the upper and lower frequencies at which output falls below the rated power by more than 3 dB. Because this figure is not clearly definitive, the prospective buyer should know how the designer has arrived at his specification.

**"Instant" bandwidth.** - One consideration which is not generally given as a part of the bandwidth specification, but which is critically important to the prospective buyer, is a factor described as "bandwidth availability. " In the wide variety of rf power amplifiers on the market, there are models that have a serious limitation in certain applications - they require bandswitching or tuning at the frequency being worked, or under varying load conditions.

Such amplifiers aren't necessarily useless; they *are* unsatisfactory in applications calling for frequency-swept output (rf susceptibility, instrument calibration) or applications requiring constant changes in load or frequency (filter tuning, antenna trimming). In these applications, the continual need to re-tune becomes tedious and time-consuming, and may add a factor of uncertainty to the procedure.

Good designing here can provide instantly available output at any frequency in the operating spectrum - "instant" bandwidth. The stability and sweep capability implied by instant bandwidth are important factors for the prospective buyer to understand. An amplifier's stability assures the predicability necessary in research, testing, and calibration applications. Sweep capability - even if the application doesn't absolutely require it - means entirely stable, instantly available output power anywhere in the operating spectrum that the procedure calls for.




**Amplifier linearity** - Linearity is the ability of an amplifier to deliver output power in exact proportion (the gain factor) to the input power. Linear amplifiers are required in AM applications, for example, where the linearity specification indicates how hard the amplifier can be driven before distortion appears in the output.

**Gain compression** - Non-linear response appears in an amplifier when the outputs are driven to a point near saturation. As this level is approached, the amplifier gain falls off, or compresses. The tracking relationship between output and input levels is a direct function of the gain factor; when the gain compresses, the amplifier's linearity is lost.
The linearity specification can be expressed as the output level at which the gain compresses by a given amount. Amplifier Research specifies linearity at the 1.0 dB gain-compression point, illustrated in the input vs output graph on this page.
Occasionally, an amplifier will be rated for both linear and non-linear operation. Non-linear amplifiers - for instance, those used in pulse mode or FM operation - are often driven at saturation to achieve the desired flatness specification. In amplifiers rated both ways, the linear output will always be some figure well below the saturated, non-linear output. If an amplifier is designed solely for non-linear use, however, the prospective buyer should know that it may not be at all suitable for linear applications. Operation of the output stages at a level below saturation will, in some cases, seriously affect flatness.

**Harmonic distortion** - All amplifiers create harmonic distortion (multiples of the fundamental frequency) to some degree. It shows up as a power loss in the fundamental, and is caused largely by non-linearity in individual stages. While it isn't entirely avoidable, the extent to which it occurs is still a matter of design, and therefore still in the hands of the designer. A number of techniques can be used to minimise harmonic distortion; AR has developed technology that incorporates these methods - often in combination - into high-power, broadband design.
Class A operation of small-signal stages, and - where possible - output stages, produces the lowest distortion figures. For higher-power solid-state applications where class A operation isn't feasible, class AB push-pull outputs are employed conservatively to achieve nearly comparable distortion levels. Harmonic filtering, particularly in amplifiers operating over a narrower bandwidth (less

than one octave), is effective in reducing harmonic components in the output. Finally, the designer - with careful design and layout of the circuit - can shape gain and frequency in the amplifier to introduce the least amount of distortion.

Harmonic distortion is specified as the harmonic content of the overall output. The actual specification is usually a statement - in dB - of how far below the fundamental the harmonic content lies at rated output.

**Intermodulation distortion** - Intermodulation distortion is, like harmonic distortion, always present to some degree in any amplifier; again, the culprit is non-linearity. A device operating with any degree of non-linearity and passing two or more signals acts as a mixer and introduces sum-and-difference products of the applied frequencies. Many of the same techniques described above are used to minimise intermodulation distortion, although IMD is generally not as important a consideration in broadband rf power applications as is harmonic distortion.

The expression of intermodulation distortion is somewhat more difficult than that of harmonic distortion; the variables involved - the number of tones and their relative power, frequency, and separation - preclude a simple procedure for providing a meaningful figure. To overcome this difficulty, Amplifier Research uses the intercept-point method, and the amplifiers which have an IMD rating give it at the third-order intercept point.

**Amplifier protection** - When the designer considers the ability of his circuit to withstand reflected power from a load mismatch, he makes a decision - one which drastically affects an amplifier's usefulness in many applications.

An easy way of protecting the circuit from a high VSWR is to design it to shut off under adverse conditions. This works; but is also has the effect of taking a large degree of freedom out of the hands of the user. In applications where adverse conditions are the norm - testing and aligning power filters, for instance - the load is *rarely* matched to the amplifier. If the amplifier shuts down immediately under adverse load conditions, the user is left with a tedious process of trial-and-error to bring the load close enough to the correct impedance to allow amplifier operation.

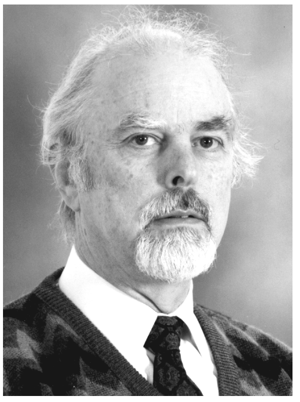
By combining good design techniques with conservatively rated devices, however, the designer can come up with a circuit that will continue to operate under worst-case conditions. This is more than a nicety; ability to withstand high VSWR loads means that the amplifier output stages can completely absorb, reflected power, and still function. The amplifier therefore cannot be damaged by poor cable connections, faulty cables, or any of the myriad other conditions that can be expected in normal use. And because the amplifier will work into any load condition, the user has full operating capability for any conceivable application.

**Reading between the lines** - Given the availability of high-quality, state-of-the-art devices, the major differences in the amplifiers on today's market boil down to a matter of design excellence. Clearly stated, conservative power and bandwidth ratings imply conservative design techniques - and the availability of headroom in the design itself. Instant bandwidth and imperviousness to high VSWR loading indicate a level of design excellence that assures the user maximum reliability and flexibility.

Article courtesy of Amplifier Research "Guide to broadband power amplifiers."

# ANTENNAS AND ELECTROMAGNETIC VISUALISATION

**A presentation by Mr. Alan Nott**



On Wednesday, 17th June, Mr. Alan Nott delivered a short address on the above topic.

The presentation took place in the IEAust auditorium at North Melbourne and was well attended by a group of some thirty, interested guests.

Alan's work involves the marriage of two diverse computer-modelling activities - one in electromagnetics and the other in three-dimensional visualisation. Traditionally these two streams have not been combined as one is the domain of the scientific researcher and the other is the domain of the graphic artist/illustrator. The outputs of electromagnetic modelling packages, such as Numerical Electromagnetic code (NEC) are in the form of large tables of figures, or at best two-dimensional contour plots. MATHCAD and similar programs can produce three-dimensional depictions of these complex data sets, but these generally lack 'realism' in the visual sense. Alan has ported modelling outputs to 3D Studio, a graphics package traditionally used in the architectural, advertising and art industries. The results graphically illustrate the nature of the complex structures of electromagnetic fields around antennas and associated platforms. Sweeping the frequency, antenna height, or other antenna parameters produce dynamic illustrations, which add a further dimension to the understanding of antenna radiation patterns.

Alan presented a range of examples of his work that emphatically demonstrated the power and benefits of using this technique. This is certainly an area where a video is worth a million sets of figures. Applications of this technique are numerous. Some examples are communications system operator training, radiation hazard prediction, general communications education, communications system frequency and selection optimisation, and developing solutions to communication system problems.

Alan is employed by the Australian Army's Army Technology and Engineering Agency (ATEA) as a Technical Specialist Engineer.

# *PEOPLE IN THE NEWS*

## VISITORS FROM PAKISTAN

Dr Hasnain Syed, the General Manager of the electromagnetics division of the Advanced Engineering Research Organisation (AERO) of Pakistan, recently attended a two-week, condensed, EMI training course at RFI Industries in Melbourne.

A team of three engineers, who had diversified backgrounds enveloping both software development and instrumentation, accompanied him.

The major portion of the instruction encompassed the test procedures, instrumentation and solution techniques, as well as specialised software programs, involved in performing testing in accordance with US military specifications, Mil Stds 461, 462 and 463.

During their stay they were also able to visit a number of other test installations and research facilities as well as enjoying some shopping and sight seeing.

# *EMC STANDARDS*

## EMC IN TAIWAN

January 1, 1997, saw the introduction of EMC regulations in Taiwan for conformance for emissions.
The Chinese national Standards are

| | | |
|---|---|---|
| CNS 13306 | ISM EQUIPMENT | (CISPR 11) |
| CNS 13439 | Radio / TV | (CISPR 13) |
| IEC 335 | Appliances | (CISPR 14) |
| CNS 13306 | Methods | (CISPR 16) |
| CNS 13438 | ITE | (CISPR 22) |

No immunity standards have been selected although their policy does provide for future adoption.

The Bureau of Commodity Inspection and Quarantine (BCIQ) is the responsible organisation in Taiwan for granting laboratory accreditation.

## EMC IN RUSSIA

From January 1, 1999, both emissions and immunity tests will be required for entry into the Russian market.

The Russian Federation Committee for Standardisation Methodology and Certification (Gosstandard) is the accrediting body in Russia. However at this time there are no GOST accredited laboratories outside Russia and Russia does not accept testing to European EN standards.

## ACCREDITATION TESTING BODIES - WORLDWIDE

| | |
|---|---|
| EUROPE | UKAS/NAMAS, STALAG, DANK, SWEDAC, SINAL, COFRAC, RELE |
| RUSSIA | GOST |
| AUSTRALIA | NATA |
| USA | NVLAP, A2LA |
| HONG KONG | HOKLAS |
| TAIWAN | BCIQ |
| NEW ZEALAND | IANZ |

# CURRENT AUSTRALIAN/NEW ZEALAND STANDARDS

| | | |
|---|---|---|
| AS/NZS 4251 | 1994 | Generic emission standard |
| AS/NZS 1044 | 1995 | Electrical motor-operated and thermal appliances for household and similar purposes, electric tools and similar apparatus. |
| AS/NZS 1053 | 1996 | Sound and television receivers and associated equipment. |
| AS/NZS 2064.1/2 | 1992 | Industrial, scientific and medical equipment. |
| AS/NZS 2557 | 1992 | Vehicles, motor boats and spark ignition engine driven devices. |
| AS/NZS 2772-1 | 1998 | Radio Frequency Fields Part 1 Maximum Exposure Levels (Interim) |
| AS/NZS 3548 | 1995 | Information technology equipment. |
| AS/NZS 4051 | 1994 | Electrical lighting and similar equipment. |
| AS/NZS 4052 | 1994 | Microwave ovens. |

### Emission Standards

The Radio Frequency (RF) emission standards are intended to reduce the levels of intended emissions from electrical and electronic goods to an acceptable level. They were introduced on a mandatory basis from 1 January 1997 and are the first standards to be phased in by the ACA as part of the EMC framework.

### Immunity Standards

Immunity standards are not currently mandatory under the EMC framework. The basic strategy of the EMC framework is to provide for management of both emissions and susceptibility over time. The role of immunity standards is to establish a basic level of protection for products that are susceptible to interference effects. The ACA has advised that it will reconvene a working group to consider extending the EMF framework to cover immunity standards and systems and installations. ACA staff are currently preparing a discussion paper on these issues and have requested input on the application of immunity standards and how EMC standards might be applied to systems and installations.

# EUROPEAN STANDARDS

| | | |
|---|---|---|
| EN 50081-1 | Emissions | Residential, Commercial, Light Industrial - Generic |
| EN 50081-2 | | Heavy Industrial - Generic |
| EN 50082-1 | Immunity | Residential, Commercial, Light Industrial - Generic |
| EN 50082-2 | | Heavy Industrial - Generic |
| EN55011 | Emissions | ISM Equipment |
| EN55013 | | Broadcast & TV Receivers |
| EN55014 | | Household Appliances, Portable Tools |
| EN55015 | | Lighting and Luminaires |
| EN55022 | | Information Technology Equipment |
| EN55103-1 | | Professional Audio & Video Equipment |
| EN55065-1 | | Mains signalling |
| EN55020 | Immunity | Broadcast & TV Receivers |
| EN555014-2 was EN55104 | | Household Appliances, Portable Tools |
| EN55130-4 | | Alarms |
| EN61547 | | Lighting and Luminaires |
| EN55103-2 | | Professional Audio & Video Equipment |
| EN61131-2 | | Programmable Controllers |
| EN50199* | Emissions/ Immunity | Arc Welding |
| EN50083-2 | | Cable TV |
| EN50091-2 | | Uninterruptible Power Supplies (UPS) |
| EN60601-1-2 | | Medical Equipment |
| EN60945 | | Marine Navigation Equipment |
| EN60870-2-1 | | Telecontrol Equipment |
| EN 6100-4-2 | Immunity | Electrostatic Discharge |
| EN 6100-4-3 | | Radiated Radio Frequency Electromagnetic Fields |
| EN 6100-4-4 | | Fast Transients/Bursts |
| EN 6100-4-5 | | Surges |
| EN 6100-4-6 | | Conducted Radio Frequency Electromagnetic Fields |
| EN 6100-4-8 | | Magnetic Fields (50 Hz) |
| EN 6100-4-11 | | Voltage Dips, Short Interruptions & Voltage Variations |
| EN 6100-3-2 (EN 60555-2) | Emissions | Mains Harmonics |
| EN 6100-3-3 (EN 60555-3) | | Mains Flicker |

# *CALENDAR OF EVENTS*

**August 24 - 28, 1998** Denver, Colorado, U.S.A. 1998 IEEE International Symposium on Electromagnetic Compatibility
Contact: Barry Wallen www.ball.com/aerospace/ieee_emc.html

**September 14 - 18, 1998** Rome, Italy. EMC 98 Roma International Symposium on EMC.
Contact: D.Fioramonti Telephone 39 2 777 901

**February 16 - 18 1999** Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility
Contact: emc@nari.ee.ethz.ch

**March 23 - 25 1999** EMV99 Exhibition and Conference on Electromagnetic Compatibility (EMC)
Contact: Messe und Kongreb
e-mail: fetzer@mesago.de

# *NEW MEMBERS*

For those who have not yet joined our EMC Society we would ask you to fill in our membership application form and encourage your colleagues to follow suit. If you have applied for membership but not yet received an invoice from IEAust, would you please fill in and submit a new application form.

# *MAILBOX*

We invite all our members and readers to participate in our quarterly newsletter. In order to produce a better newsletter and provide our readers with the information and items of interest looked for, we welcome your comment, advice and criticism. Particularly, we would look forward to receiving technical articles, amusing anecdotes and items of general interest to the EMC community.

# *CORPORATE MEMBERSHIP*

The EMC Society offers corporate Membership to organisations who may wish to nominate up to three people for membership. It also provides an important source of funding to the Society and we would like to take this opportunity to recognise the 1998 corporate Members.

**ADVANTEC ELECTRONICS Pty Ltd** is a registered NATA test house with accreditations for testing to TS001, TS002, TS004, TS006 and TS008.
Contact: David Stocks (02) 9477 7757

**ROBERT BOSCH AUSTRALIA** is a manufacturer of white goods and specialised electronic automotive products.
Contact: Steve Offer (03) 9541 5474

**TENIX DEFENCE SYSTEMS** is a manufacturer of specialised defence systems.
Contact: David Willetts (03) 9244 4134
The EMC Society would like to express gratitude to Advantec, Robert Bosch and Tenix Defence for their support in 1998.

## Institutional Listings

The IEAust Electromagnetic Compatibility Society is grateful for the assistance given by the firms listed below and invites application for Institutional Listings from other firms interested in the electromagnetic compatibility field.

# The Institution of Engineers, Australia

## ELECTROMAGNETIC COMPATIBILITY SOCIETY

## MEMBERSHIP APPLICATION FORM

Please return this form to: Electromagnetic Compatibility Society of Australia
The Institution of Engineers, Australia
PO Box E303
KINGSTON ACT 2604
Australia

Title ______ Surname/Company ______ Other Names/ Groups ______ Student Yes/No ______

IEAust Member Yes/No ______ Contact ID ______

Corresponding Address ______

Alternate Address ______

Work Phone ______ Fax ______ Home Phone ______

Mobile No. ______ Email Address ______

Employer ______ Position ______

Address ______

**FEES** (Applicable to year commencing 1st January)

| | | |
|---|---|---|
| (a) | IEAust Member, other than a student | $80 |
| (b) | Non IEAust Member | $85 |
| (c) | Corporate Member | $500 |
| (d) | Student / Retired Members | $25 |

Payment Details Cheque/Money Order enclosed for $ ______

**OR**

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Signature: ______ Amount: $ ______ Expiry Date ___/___

# Institutional Listings

## HEWLETT-PACKARD AUSTRALIA LTD

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IEC 1000-4-3 Radiated
IEC 1000-4-4 Transient
IEC 1000-4-5 HV Surge
IEC 1000-4-6 Conducted RF
IEC 1000-4-11 PS Interruptions

**Emissions Including**
AS/NZS 1044/CISPR 14: Appliances
AS/NZS 1053/CISPR 13: TV, Radio, Audio
AS/NZS 2064/CISPR 11: ISM
AS/NZS 3548/CISPR 22: ITE
AS/NZS 4051/CISPR 15: Lighting
AS/NZS 4251/EN50081: Generic

## MFB PRODUCTS PTY LTD

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FC

An Institutional Listing recognises contributions to support the publication of **THE IE AUST ELECTROMAGNETIC COMPATIBILITY SOCIETY** newsletter. Minimum rates are $200.00 for a listing in one issue. Larger contributions will be most welcome. No agency fee is granted for soliciting such contributions. Inquiries, or contributions made payable to the EMC Society, plus instructions on how you wish your Institutional Listing to appear, should be sent to the Editor, EMC Society Newsletter, IE Aust, 11 National Circuit, Barton, A.C.T. 2600.