SESSION 8: FET AMPLIFIERS

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During the past five years FET device and amplifier circuit technology has advanced significantly. Five years ago, the papers presented at the MTT Symposium in Orlando, Florida reflected the activity within the microwave community to demonstrate the feasibility of 1 watt FET power amplifiers over narrow bandwidths in C and X-band. During the next few years, as device process technology was refined to enhance device yields and extend producible power device designs to submicron gate geometries, circuit techniques were being successfully applied to FET power amplifiers providing 1 watt over an octave in X and Ku-band.

This year's papers reflect a continued focus on the expansion of amplifier performance to multi-octave bandwidths and higher frequencies extending into the millimeter wave bands. They also indicate emphasis on applying FET amplifiers to near term electronic warfare and communication systems applications. Results reported for multi-octave 1 watt FET amplifiers demonstrates the viability of a solid state alternative to TWT's in EW systems, while data for a Ka-band power amplifier indicates that alternative designs for earth station transmitters may soon be possible. Furthermore, there is continued emphasis on application of FETs to communication systems requiring highly linear power amplifiers.

The session begins with a paper from Watkins-Johnson Company which investigates the performance of several amplifier circuit design approaches for application to multi-stage single-ended amplifiers covering multi-octave bandwidths. A comparison of the wideband performance of feedback, distributed and lossy match amplifier configurations provides valuable insight for circuit designs who are considering alternatives to the classical balanced reflective match amplifier.

In the next paper Raytheon demonstrates a successful blend of state-of-the-art, large periphery, submicron power FETs and broadband matching network design to demonstrate a productized 1 watt amplifier covering the 8-17GHz band. Attention to ECM system performance requirements required incorporation of temperature gain compensation circuits as well as a packaging approach aimed at large volume low cost production.

The third paper is from Texas Instruments, and describes the design of a number of critical components used in the demonstration of a 1 watt solid state TWT replacement amplifier covering the 2-10GHz band. Feedback amplifiers utilizing GaAs FETs are used as a small signal gain block in various portions of the amplifier chain. A serrodyne amplifier module is demonstrated which effectively incorporates wideband amplifier, temperature compensation and mixer circuits.

The next paper, details the experimental results on the third-order nonlinearity performance of C-band power FETs developed at Bell Laboratories. The authors present evidence that the devices act as third-order devicesup to output powers of 2 watts. Furthermore the data indicates that proper choice of gate bias conditions can reduce contributions of gain distortion to negligible levels.

The concluding paper in the session, from Mitsubishi applies power combining techniques to demonstrate 1.5 watts of output power at 28GHz. Four FET amplifier modules are combined using waveguide branch-line couplers to obtain an overall combining efficiency of 90%.

In summary, the work reported in the 1984 MTT-S Symposium session dealing with FET amplifiers clearly demonstrates a continued emphasis on this technology within the microwave community. These engineering advances contribute to an objective within the industry to enhance the performance of microwave systems through the application of GaAs FET technology.

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