

MEASUREMENT TECHNIQUES APPLIED

A special computer-controlled network analyzer was built to extend its measurement capability to 26.5 GHz in order to allow evaluation of the transmission and reflection characteristics of this new connector. A special slotted line was also constructed to measure the bead reflections up to 34 GHz using Sanderson's technique [4]. Furthermore, tuned waveguide reflectometers with waveguide-coax adapters were utilized to verify measurement results taken by the aforementioned techniques.

Insertion loss and repeatability measurements are taken with the automatic network analyzer to 26.5 GHz and above 26.5 GHz with detectors and ratio-measuring equipment.

Leakage tests of a connector pair were measured at frequencies up to 26.5 GHz. A triaxial test fixture was built that is similar to the fixtures described in [5] and [6]. It was built so that a bending moment could be applied to the 3.5-mm connector. Cutoff frequency of this triaxial fixture for the TE_{11} mode is about 6 GHz.

Three test setups were used in the leakage test. First a standard spectrum analyzer setup was used. The dynamic range and frequencies of these measurements were from 110 dB at 100 MHz to 90 dB at 16 GHz. The second test method used a waveguide setup in *K* band similar to the modulated subcarrier described in [5]. The leakage test was performed across the full waveguide band from 18 to 26.5 GHz. The dynamic range of this test was 100 dB. The third test method was a double conversion setup using three synthesizers operating in a screen room from a common 10-MHz reference oscillator. The bandwidth of the measurement was 1 Hz yielding excellent test capabilities. Measurements were made at two frequencies—at 8 GHz the dynamic range was 148 dB; at 17.9 GHz it was 138 dB.

The swept measurements from 18 to 26.5 GHz were made under several conditions. The condition most likely to show leakage was: coupling nut tightened to 0.6 Nm with a 1-Nm bending moment applied to the outer conductor per [7]. The result of all measurements of leakage was that no discernable change in system noise level was observed (see Table II). Connector pair leakage was below the dynamic range of all measurements.

CONCLUSION

This connector has distinct advantages in performance and price as described previously. Furthermore, it is directly compatible with the most widely used SMA connector.

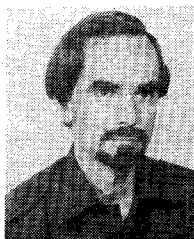
ACKNOWLEDGMENT

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- [6] F. R. Huber and H. Neubauer, "Measurement techniques for the determination of the major characteristics of coaxial components," *Microwave J.*, pp. 196-204, Sept. 1962.
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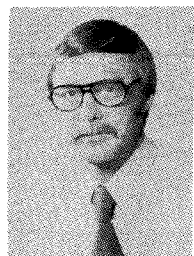
Contributors



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Dan A. Bathker (S'59-M'62-SM'75) was born in St. Paul, MN, on October 17, 1938. An early interest in radio and related topics lead to obtaining an amateur radio license, held continuously since 1953. He received the B.S. degree in electronic engineering from California State Polytechnic College, San Luis Obispo, CA, in 1961.

Since joining the Jet Propulsion Laboratory Telecommunications Division in 1963, he has been engaged in large ground antenna micro-

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Mr. Bathker is presently the Supervisor of the Antenna and Propagation Group, has been active as an Industrial Consultant, and has received a NASA major monetary award. He is a member of the IEEE S-AP and S-MTT groups, Tau Sigma, and Sigma Xi.

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Berthold G. Bosch (M'64-SM'67) was born in Bonn, Germany, on May 30, 1930. He received the Dipl. Ing. degree from the Aachen Technical University, Aachen, Germany, in 1956, the Ph.D. degree from the University of Southampton, Highfield, Southampton, England, in 1960, the Habilitation from Karlsruhe University, Karlsruhe, Germany, in 1969, and the D.Sc. degree from the University of Southampton in 1976, all in electrical engineering/electronics.

From 1956 to 1957 he held an AEG Foreign Scholarship at the Electronics Department of the University of Southampton, while subsequently during 1958–1960 being a Research Assistant at the same department engaged in work on microwave-tube noise. From 1960 to 1972 he was with AEG-Telefunken, Ulm, Germany, where he occupied various posts in the Tube Works and in the Research Institute, ultimately being Head of the Electronics Department in the latter institution. During that time he carried out or was responsible for work on microwave tubes, parametric amplifiers, microwave semiconductors, and high-rate PCM circuitry. In 1969 he was made an Adjunct Staff Member (Privat-Dozent) in the Faculty of Electrical Engineering of Karlsruhe University, and in 1972 he accepted the Chair of Electron Devices at Ruhr-University, Bochum, Germany, where simultaneously he became Joint Director of the Institute of Electronics. From 1973 to 1974 he served as Dean of the Faculty of Electrical Engineering and as a Member of Senate.

Dr. Bosch was awarded the A.F.-Bulgin Premium of the Brit. IRE in 1962, and in 1969 he received an Annual Prize of the Nachrichtentechnische Gesellschaft. He is author or coauthor of about fifty scientific publications, inventor or coinventor of over forty issued patents, and coauthor (together with R. W. H. Engelmann) of *Gunn-Effect Electronics*.

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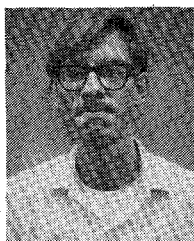


Richard M. Cox (M'62) was born in King George, VA, on September 7, 1935. He received the B.S. degree in electronic engineering from the Indiana Institute of Technology, Fort Wayne, in 1959.

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Rob Hartop received the B.S. degree in engineering physics in 1958 from the University of Maine, Orono. Awarded a Hughes Fellowship, he was employed by Hughes Aircraft Company and studied at the University of California, Los Angeles, obtaining an M.S. equivalent in electrical engineering.

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Stuart T. Jolly received the B.Sc. degree in metallurgy from the University of Wales, Cathays Park, Cardiff, Wales, in 1939.

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From 1963 to 1968 he was an engineering group leader with RCA Defense Electronics Products responsible for the development work in computer memories (ferrite core, plated wire, NDRO, and ROM); the automated test equipment studies including design and construction of an automated tester for computer tape recorders; and setting up a facility for the production of high-resolution photomasks to be used in the manufacture of integrated circuit devices. He was the Senior Engineer responsible for the initial design and process development for liquid crystal displays. As a member of the Technical Staff, his present assignment is the development of epitaxial growth processes and production of material for solid-state microwave devices with the Microwave Technology Center located at the David Sarnoff Research Center in Princeton, NJ. He holds two patents in the field of magnetic memories and magnetic recording.

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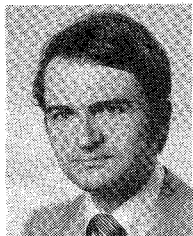
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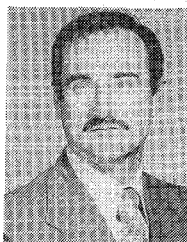
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Klaus Mause was born in Oppenheim/Rhein, Germany, in 1932. He received the Dipl. Ing. and Dr. Ing. degrees in electrical engineering, both from the University of Karlsruhe, Karlsruhe, Germany, in 1963 and 1967, respectively.

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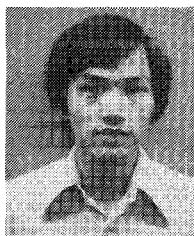


Thomas F. McMaster was born in New York City, NY, in 1944. He received the B.S.E.E. degree from Drexel University, Philadelphia, PA, in 1972 and the M.S.E.E. degree from the Polytechnic Institute of Brooklyn, Brooklyn, NY, in 1974.

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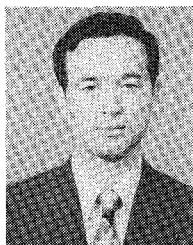


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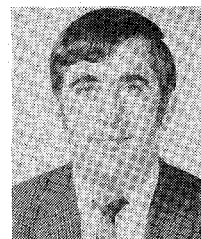


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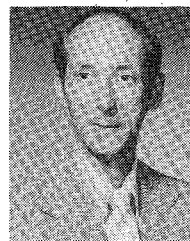


Rene E. Smith was born in Surabaja, Indonesia, on July 18, 1932. In 1950 he went to The Netherlands where he attended the Technical School in Amsterdam.

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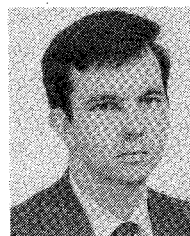


William W. Snell, Jr., was born in Williamsport, PA, on July 3, 1932. He graduated from the Williamsport Technical Institute, Williamsport, PA, in 1951.

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William R. Wisseman (M'72) was born in Hallettsville, TX, on November 2, 1932. He received the Bachelor of Nuclear Engineering degree from North Carolina State College, Raleigh, in 1954, and the Ph.D. degree in physics from Duke University, Durham, NC, in 1959.

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Later he studied electromagnetic wave propagation in solid-state plasmas. He has been involved in GaAs microwave device research since 1965 and currently is manager of the Advanced Microwave Components branch of the Advanced Components Laboratory.

Dr. Wisseman is a member of the American Physical Society, Sigma Xi, Phi Beta Kappa, Tau Beta Pi, and Phi Kappa Phi.