

## 1996 MICROWAVE APPLICATIONS AWARD

### Dr. Kikuo Wakino

The Microwave Application Award is presented aperiodically to individuals for an outstanding application of microwave theory and techniques. The eligibility requirements are creation of a new device, component or technique, or a novel use of components, or both. The award consists of a plaque, certificate, and an honorarium of \$1,000.

Dr. Kikuo Wakino, the 1996 recipient, was responsible for the development of low-loss, temperature-stable, dielectric resonators at Murata Manufacturing Company. Dr. Wakino is an IEEE Fellow. His award citation reads: "FOR PIONEERING THE DEVELOPMENT OF LOW-LOSS, TEMPERATURE-STABLE, CERAMIC DIELECTRIC RESONATORS."

**Dr. Kikuo Wakino** was born on August 30, 1925, in Kyoto Japan. He received the B.S. degree in Physics and Doctor of Engineering in Electrical Engineering, both from Osaka University in 1950 and 1980, respectively. He joined Murata Manufacturing Co. Ltd. in 1952 and engaged in the research and development of dielectric materials for ceramic capacitors. By the end of 1952, he had established techniques for producing temperature compensated, high K ceramic capacitors.

In 1955, Dr. Wakino started research and development work on the Lead Zirconate Titanate (PZT) ceramics group for application to piezoelectric devices, such as ceramic IF filters, piezoelectric transducers, etc. In 1960, he established a mass production line for PZT ceramics. He started research and development work on dielectric ceramics for microwave application in 1971, and succeeded in demonstrating ultra low loss, temperature stable dielectric ceramics and dielectric resonators in 1973. He organized and conducted an R&D working group for dielectric resonators and microwave filters in 1973.

Dr. Wakino and his colleagues developed a miniaturized 4.5 GHz bandpass filter using the ring type  $TE_{01d}$  mode resonator (the first practical microwave filter using temperature stable dielectric resonators), and reported this work at the MTT-S Symposium in Palo Alto in 1975. In 1978, the local oscillator for a satellite broadcast receiver was developed by his group and was produced for this class of applications.

He lead a developmental project for a miniaturized filter using the coaxial type (TEM mode) dielectric resonator for 800 MHz band mobile telephone system in 1981. The development was extended to the monoblock type diplexer for portable telephone terminals in 1982. These filters have been designed and manufactured for most of the cellular mobile telephone systems such as AMPS, NTT and E-TACS. Filter circuit volume for these applications has been reduced from 270 cm<sup>3</sup> in 1978 to 0.7 cm<sup>3</sup> in 1994.



He also conducted an extended program to develop high power filters for cellular base stations. Using low loss and linear (Zr, Sn)TiO<sub>4</sub> resonators, his group eliminated cross talk problems between neighboring channels and developed high power filters for cellular base stations. Several types of dielectric resonators and filters have been built and supplied as a key device in satellite transponders.

Dr. Wakino is the author and co-author of more than 30 papers in international journals and holds more than 20 patents. He has presented 7 invited talks at the symposiums and workshops of MTT-S and the American Ceramic Society. He is a Fellow of IEEE and of the American Ceramic Society. He received both the Blue Ribbon Medal and Fellow Award of The Science and Technology Agency of Japanese Government in 1988. He also received the Award of Technical Progress from Japanese Ceramic Society in 1978. He is a member of the American Physical Society, the Physical Society of Japan, and the American Ceramic Society.