C-29

Pioneering Study on Broadband Radio Wave Absorbent

In terms of environmental electromagnetic problems, lines to remove obstacles due to electromagnetic waves are to reduce the radiative power of unnecessary electromagnetic waves and to increase resistance properties against unnecessary electromagnetic waves. Radio darkrooms are important for the measurement of irradiation electromagnetic waves from electronic information equipment and the measurement of resistance properties against interference electromagnetic waves, and it is indispensable to install radio wave absorbent to build this space. In combination with the radio wave absorbent prepared using ferrite having the properties of—a thickness of 2 cm, return loss, 20 dB or more in the frequency range of 30 MHz to 1,000 MHz, ferrite, and an electrical conducting loss material, they developed a broadband radio wave absorbent having the properties of—a return loss, and 20 dB or more in the frequency range of 30 MHz to 1,800 MHz.

C-30

Upgrading of Microwave Power Amplifiers

In modern society, mobile phones and smartphones are indispensable information equipment. The 4G mobile phone system (LET) has spread globally, and research and development of 5G is ongoing. Microwave power amplifiers (PA) are crucial for base station infrastructure and mobile terminals which support such activities. In order to realize the downsizing of equipment, low power consumption, and long-hour operation of terminals, it is crucial to upgrade PA performance.

The power consumption of PA accounts for a large portion of the power consumption of base-station equipment, so power efficiency of PA has a considerable impact on the power consumption of overall equipment and its size. In addition, after LTE, in order to get high frequency usage efficiency, linear modulation was employed, resulting in high efficiency and linearity are required for PA. Because of this, strain compensation to suppress PA's non-linear strain become important. In particular, for the amplification of broadband signals such as W-CDM and LTE, the kinetic non-linear strain memory effect becomes problematic. The digital pre-distortion (DPD) technology to compensate the said memory effect PA devices and PA circuits was developed in the beginning of the 2000s. Because of this, power efficiency improved as much as three times the efficiency of feedforward type PA which was the mainstream method for the compensation of base-station PA at the beginning of the development, contributing to the early realization of high-capacity base stations.

In designing User Equipment (UE), the reduction in size and weight are important factors, and thus the reduction in mounting capacity for various circuits is a continuing challenge. Along with the sophistication of high-speed/large capacity mobile phone services, the number of bands to be met by UE increased. As a solution to control swelling capacity of UE, various multiband high frequency circuits were proposed. In this case, to satisfy both conditions— small/lightweight and yet maintaining a performance equal to that for single band—were difficult problems. In 2010, the development of a new PA was announced before the rest of the world, which had an electric performance equal to single band PA. Its properties were obtained by means of a method to adjust frequency properties with a simple variable mechanism employing switches in the matching circuit. These electric properties include 9 bands between 0.7 and 2.5 GHz, a small-signal gain of 30 dB or more, an output of 34 dBm or more, and a maximum additional power efficiency of 40% or more. In 2011, another condition—downsizing—was cleared. PA having the size of about 6 x 8mm and 1.5 to 2.5GHz radio communication.

Needs, efforts and success revolved around radio information, and PA in particular, had a considerable impact on engineers having similar problems in a wide range of fields, e.g., researchers on software radio and cognitive radio as well as researchers on devices, and eventually led to later studies about multiband, wideband, and variable circuits.

UE: User Equipment