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# Integrated SAW Broadband Antenna for WLAN/ WIMAX

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**Анотація**

В даній статті описується SAW пристрої які набули широкого застосування в сучасному житті людей та зіграли важливу роль в системах бездротового зв'язку, так як SAW пристрої мали перевагу низької вартості маленькі розміри, простоту реалізації та високу пропускну здатність.

**Ключові слова:** бездротовий зв'язок, WIMAX, інтегрований широкосмуговий зв'язок.

**Abstract**

This article describes the SAW devices are widely used in modern life and played an important role in the wireless communication system, as SAW devices have the advantage of low cost small size, ease of implementation and high bandwidth.

**Keywords:**wireless LAN, WIMAX, integrated broadband.

A miniaturized, integrated broadband surface acoustic wave (SAW) antenna with a size of 8.4 x 6.8 mm is designed on a 0.5 mm thick, 128 -rotated Y-cut lithium niobate (LiNbO3 piezoelectric substrate. The antenna is constructed, using four cross-coupled half-wavelength square open-loop strips and two 16 pm width interdigital transducers (IDT) of 42 pairs. Photolithography and evaporation techniques are used to realize the designed pattern. The proposed antenna has a -10 dB bandwidth of 2.2 GHz (4.8 to 7 GHz) for WLAN/WiMAX bands applications. The gain and far-field radiation patterns of the proposed antenna are also developed in this study.

Broadband antennas have aroused high interest in recent years for application to multimode witless communication systems. Because of low cost and process simplicity, printed monopole antennas are very popular candidates for these applications. One of the major challenges is the design of terminal antennas that are compact in size but have a wide impedance matched band. Many kinds of broadband antennas have been studied. Most printed circuit boards (PCB), made of FB-4 which has a relative permittivity of approximately 4.4, could not be used to fabricate antennas with smaller sizes, and they could be difficult to integrate in radio frequency/ microwave circuitry. SAW devices have been widely fabricated and played an important role in wireless communication systems, because the SAW devices had the advantages of low manufacturing cost, miniaturization, light weight, easy realization, easy integration and better isolation between the radiating element and feeding network. The proposed broadband SAW antenna can be easily integrated with other circuit components to form a complete system. Details of the antenna design and performances are presented.

This antenna is fabricated on a 128°-rotatedY-cut lithium nio- bate (LiNb03) piezoelectric substrate, with a thickness of 6.5 mm. A 50 Q SMA connector was welded as the input. As shown, this antenna is composed of two parts, which are four cross-coupled half-wavelength square open-loop strips and two 16 pm width interdigital transducers (IDT) of 42 pairs. The IDTs consist of interleaved metal electrodes, which are used to launch and receive the waves, so that an electrical signal is converted to an acoustic wave and then back to an electrical signal. The IDTs not only are the lumped capacitors, but play the role of transducers. The half wavelength square open-loop strip determines the resonant frequencies.

When the LiNb03 piezoelectric substrate is used to fabricate the microwave devices, Aluminum (Al) can be used to print the needed patterns of designed electrodes. The printed method did not need to use a FeCl3 solution to etch the Cu plate from the surfaces of PCBs. Another important reason for us to use the photolithographic technology was that it was easy for mass production and integra- tion. As the parameters showed, the designed antennas had a small size of 8.4 X 6.8 mm, which was much smaller than the monopole antennas fabricated on an FR4 substrate. Finally, the char-acteristics of fabricated antennas were measured using a vector network analyzer and a far-field measurement system.

## RESULTS AND DISCUSSIONS

The measurement of return losses is carried out with an HP8720C network analyzer. The -10 dB bandwidth for the measured return losses reaches 2.2 GHz (4.8 to 7 GHz), and can cover the 5.15 to 5.35 GHz and 5.725 to 5.825 GHz WLAN bands, as well as the 5.25 to 5.85 GHz WiMAX bands. The antenna gain variesfrom approximately -11 to -7 dBi for frequencies over the entire band.

## CONCLUSION

A compact integrated SAW antenna with broadband performance is designed and fabricated on 128°-rotated y cut LiNb03 piezoelectric substrate, using photolithography and evaporation techniques. This antenna is composed of four cross-coupled half-wave- length square open-loop strips and two 16 Width IDTs of 42 pairs. The proposed broadband SAW antenna can be designed to have a bandwidth of 2.2GHz (4.8 to 7 GHz), good radiation performance and antenna gain varying 'rom approximately -11 to -7 dBi for frequencies over the operating band, but is only 8.4 X 6.8 mm in size. This antenna is especially suited for WLAN/ WiMAX applications in small-size signal receptions and handheld mobile devices. The proposed antenna is easyto fabricate and integrated with radio frequency/microwave circuitry for low manufacturing; cost.

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