



Small Antenna Widens Design Freedom of 2.4GHz Devices

Murata Manufacturing Co., Ltd. has developed and has started mass production of the LDA21_K Series chip dielectric antenna, the industry's smallest size antenna for the 2.4GHz band ($2.0 \times 1.25 \times 1.0\text{mm}$) (Fig. 1). The LDA21_K Series is connected to a printed circuit board (PCB) after removing the ground from the chip antenna placement location on the backside of the PCB. It requires a minimum mounting footprint of $3 \times 5\text{sq. mm}$, which is the industry's smallest level for a chip antenna. While achieving characteristics equivalent to the company's conventional product, its antenna size and footprint on a PCB have been reduced to approximately 40 and 35 percent, respectively, compared to the conventional product. Murata's LDA21_K Series with compact and space-saving design will contribute to the development of smaller and thinner equipment for all applications that use the 2.4GHz band.

Development Background

Manufacturers of electronic equipment, including mobile phones, are working hard

to develop products with originality and multi-functionality in order to maintain their competitive edge. Based on this background, one of the important demands for electronic components is miniaturization. If the electronic components become more and more miniaturized, it will be easy for manufacturers of equipment, such as mobile phones and headsets, which are required to reduce the size, to design their products. In addition, miniaturization of electronic components enables higher density mounting of electronic components on the PCBs in the equipment, and this will ultimately lead to higher performance and expanded functionality of equipment. Therefore, there is a great demand for the miniaturization of electronic components from the electronic equipment manufacturers. Naturally, antennas are no exception to this demand, Murata believes that miniaturization of antennas is a necessary challenge for an antenna manufacturer.

Caution is required for adjusting the frequency characteristics, such as resonance frequency and frequency band width, which are specific requirements for antennas. This is because even if optimal frequency characteristics are obtained when a discrete antenna is evaluated, these characteristics often change and no longer conform to the required specifications when the antenna is actually assembled into electronic equipment.

There are several reasons why the frequency characteristics of an antenna change. For example, when an antenna is mounted on a PCB, the frequency characteristics change significantly depending on whether or not the ground plane is present immediately under the antenna. Furthermore,

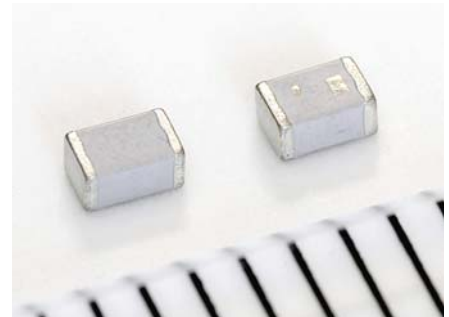
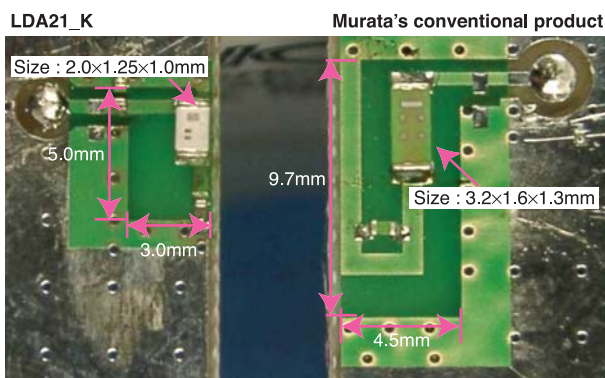


Photo 1: LDA21_K Series chip dielectric antenna

when a high-profile electronic component is placed in the neighborhood of the antenna's location, it can become a cause for change in the antenna's frequency characteristics. Obviously, a gap between the antenna and the housing or housing material has a considerable effect on the frequency characteristics of the antenna as well.

Because of the abovementioned reasons, in many cases, an antenna to be installed in portable electronic equipment is custom-designed in accordance with the design specifications of the corresponding equipment. Custom-designed products, however, have a downside, that is, there is less flexibility in being able to change the electronic equipment design. If the frequency characteristics of an antenna change and no longer conform to the required characteristics because of the design change of electronic equipment, the prototype custom-designed antenna must be manufactured again. If the time to launch an antenna product into the market is delayed due to redesigning the antenna or to making another prototype, it could cause fatal damage to the business of portable electronic equipment.

In addition to custom-designed antennas, Murata has developed and mass produced antennas that enable electronic equipment manufacturers to freely set the required frequency characteristics themselves in order to quickly and flexibly respond to their individual requirements. The advantage of this type of antenna is



	LDA21_K	Conventional product	Comparison
Size	2.0x1.25x1.0mm	3.2x1.6x1.3mm	Reduced to about 40% of conventional product
Footprint on PCB	3x5mm	4.5x9.7mm	Reduced to about 35% of conventional product

Fig. 1: Size comparison of the LDA21_K and Murata's conventional product

that it can be adjusted to the required frequency characteristics by simply changing the characteristic value of a chip component that is externally attached to the antenna without replacing the antenna itself when a change is made to the design of the target electronic equipment. The newly developed LDA21_K Series chip dielectric antenna has this advantage, while achieving size and profile reduction to meet market demands.

Features of LDA21_K Series

Among the major features of the LDA21_K Series chip dielectric antenna include: 1) the use of dielectric material with a high specific dielectric constant made from Murata's original ceramics; 2) a structural design that applies multilayer technology, which is one of Murata's strong points; and 3) an optimized antenna design by making the most of simulation technology and years of accumulated know-how on antennas.

These features made it possible to reduce the antenna size to approximately 40 percent and the footprint size to approximately 35 percent for miniaturization and space saving, even while achieving characteristics equivalent to the company's conventional product (Fig. 1). The

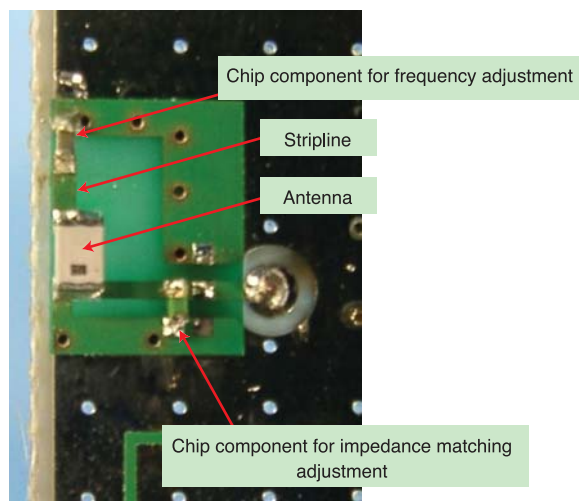


Fig. 2: Example of LDA21_K antenna mounted on PCB

Table 1: Antenna lineup

Part Number	Center Frequency (F0) [MHz]	Tolerance of F0 [MHz]	Nominal Band Width (at VSWR 4) [MHz]	Nominal Impedance [ohm]
LDA212G3110K-282	2310	+/-29MHz	-	50
LDA212G4410K-283	2460	+/-31MHz	84	
LDA212G6310K-284	2620	+/-40MHz	-	
LDA212G8610K-285	2860	+/-48MHz	-	
LDA213G1610K-286	3160	+/-58MHz	-	

LDA21_K Series also offers the advantage of low cost compared to conventional product thanks to the antenna size reduction.

Murata plans to supply the LDA21_K Series with compact size, low profile, small footprint, and low cost for the 2.4GHz band market.

Frequency Adjustment Method

The method for adjusting the frequency of the LDA21_K Series antenna is described below. For frequency adjustment, the LDA21_K Series allows users to change the characteristic values of an external chip element as in the case of conventional products, as well as to select from five types of antennas with different resonance frequencies that are provided to cope with wider frequency changes (Table 1). The users can select a model suitable for the external environment.

Fig. 2 shows an example of the LDA21_K Series mounted on a PCB. At first, a stripline is placed from the antenna to the ground plane. Next, the optimal model is selected from five types of LDA21_K Series antennas to roughly adjust the resonance frequency. Then, the chip element is connected to the stripline in series for fine adjustment. As shown in Fig. 3, by installing a chip element with different element values, fine adjustment of the antenna resonance frequency is performed by means of the change in frequency.

Murata has application

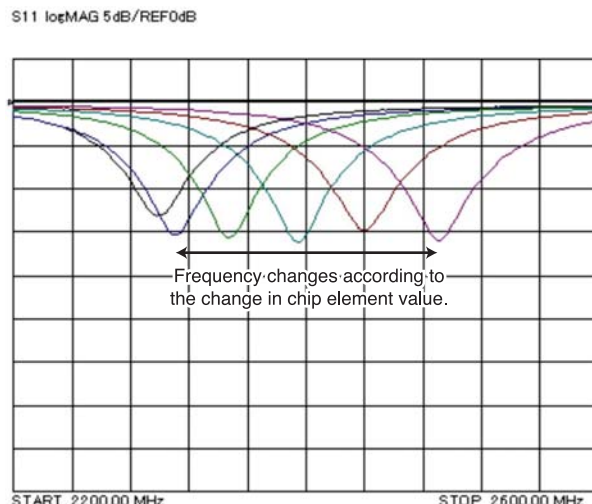


Fig. 3: Example of frequency adjusted by component for fine adjustment

data on the detailed methods for designing a stripline and on the methods for adjusting the frequency using a chip element. The company has compiled other application data as well and provides various types of information to the users.

Conclusion

Murata has always made an effort to provide a quick and flexible response to user requirements. Based on this policy, the newly developed LDA21_K Series antennas are designed to meet market demands for reduction in size and profile. Therefore, Murata believes that the LDA21_K Series antennas are valuable for users who endeavor to introduce electronic equipment with expanded functionality and higher performance quickly to the market.

Murata intends to continue developing antennas and provide quick and flexible response to user requirements. As electronic equipment becomes more diverse, the requirements of individual users for antennas are becoming more complicated every day. Therefore, with an eye toward developing antennas to meet the specific requirements of each user, Murata also strives to provide antennas that can satisfy a wide range of customers.

About This Article:

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