In this paper, a new design of an antenna array with integrated functions of filtering, harmonics suppression, and radiation is proposed. The device employs a multi-port network of coupled resonators, which is synthesized and designed as a whole to fulfill the functions of filtering, power combination/division, and radiation. The 50-Ω interfaces between the cascaded filter, power divider, and antenna in traditional RF front-ends are eliminated to achieve a highly integrated and compact structure. A novel resonator-based four-way out-of-phase filtering power divider is proposed and designed. It is coupled to the patch array, rendering a fourth-order filtering response. The coupling matrix of the resonator network is synthesized. The physical implementations of the resonators and their couplings are detailed. Compared to a traditional patch array, the integrated filtering array shows an improved bandwidth and frequency selectivity. In addition, the harmonic of the antenna array is suppressed due to the use of different types of resonators. To verify the concept, a 2×2 filtering array at S-band is designed, prototyped, and tested. Good agreement between simulations and measurements has been achieved, demonstrating the integrated filtering antenna array has the merits of wide bandwidth, high frequency selectivity, harmonics suppression, stable antenna gain, and high polarization purity.