Abstracts

Precise Design of a Bandpass Filter Using High-Q Dielectric Ring Resonators

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A precise design is presented for a bandpass filter constructed by placing TE/sub 01delta/ dielectric ring resonators coaxially in a TE/sub 01/ cutoff circular waveguide. On the basis of a rigorous analysis by the mode-matching technique, the interresonator coupling coefficients are determined accurately from the calculation of two resonant frequencies f/sub sh/ and f/sub op/ when the structurally symmetric plane is short- and open-circuited. For the TE/sub 01delta/ ring resonator, the resonant frequency f/sub 0/, the temperature coefficient tau/sub f/, the unloaded Q(Q/sub u/), and the other resonances are also calculated accurately in a similar way. From the calculations, the optimum dimensions are determined to obtain the maximum Q/sub u/, as F/sub r/ = f/sub r/ /f/sub 0/ is kept constant, where f/sub r/ is the next higher resonant frequency the ring resonator using low-loss ceramics (epsilon/sub r/ = 24.3, tan delta = 5 x 10/sup -5/) has Q/sub u/ = 16800 at 12 GHz and tau/sub f/ = 0.1±0.5 ppm/°C, while the rod one has Q/sub u/ = 14700. A four-stage Chebyshev filter having ripple of 0.04 dB and equiripple bandwidth of 27.3 MHz at f/sub 0/ =11.958 GHz is fabricated using these resonator; the measured frequency responses agree well with theory. The insertion loss is 0.9 dB, which corresponds to Q/sub u/ = 9800.

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