AN003 - C60 Application Note

Ceramic resonators

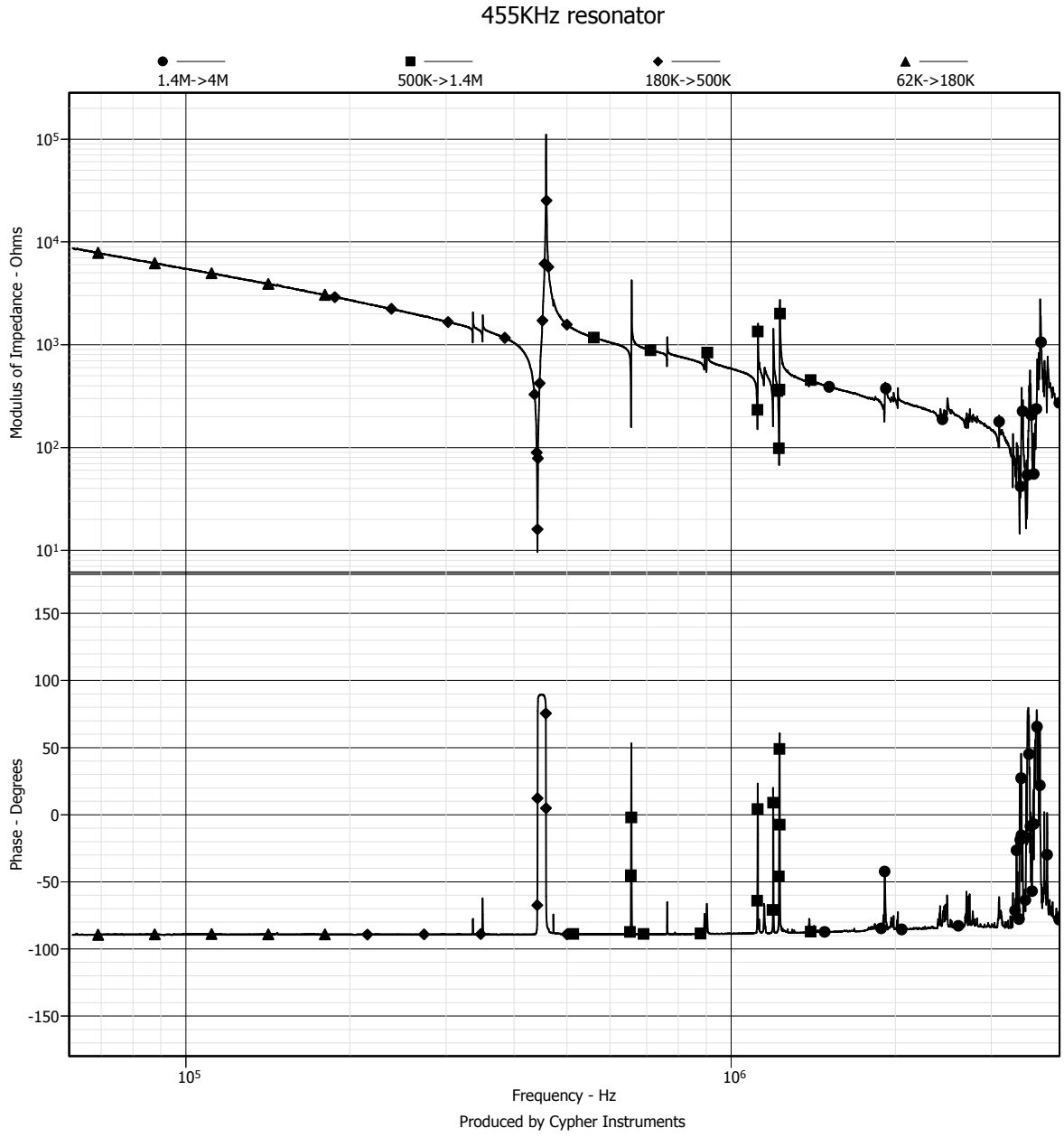

Figure 1. Impedance of a 455KHz ceramic resonator

Ceramic resonators are used in electronic circuits to construct 'low cost' reference oscillators. They are placed in the feedback loop of a high gain amplifier so that they resonate at the fundamental frequency of the device. If you think that a ceramic resonator only has one resonance mode, *then look at the graph!* Four **impedance plots** have been 'glued' together to produce a high resolution graph, in black and white with markers. The resonator is marked as 455KHz.

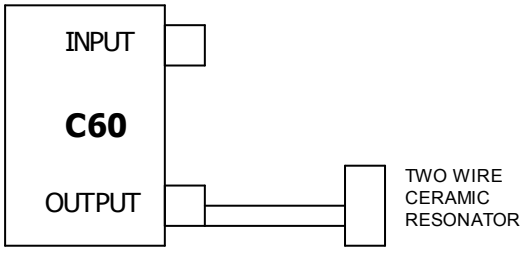

Figure 2. Connection diagram

By zooming in on the plot of the ceramic resonator (Figure 3), the magnitude of the impedance shows a minimum value of 6 Ohms which then jumps to a maximum in excess of 100K Ohms at 455KHz. Figure 4 shows another zoomed in view at just above 1.1MHz shows several other resonances and anti-resonances.

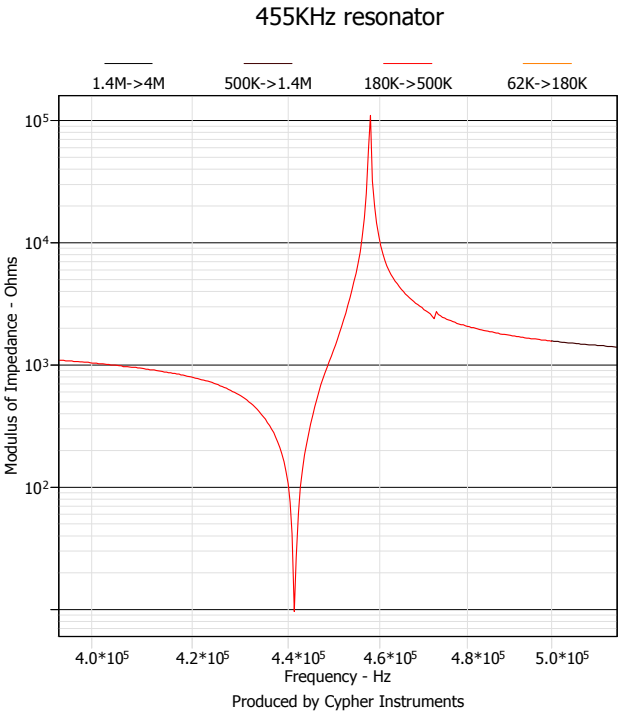

Figure 3. Fundamental resonance

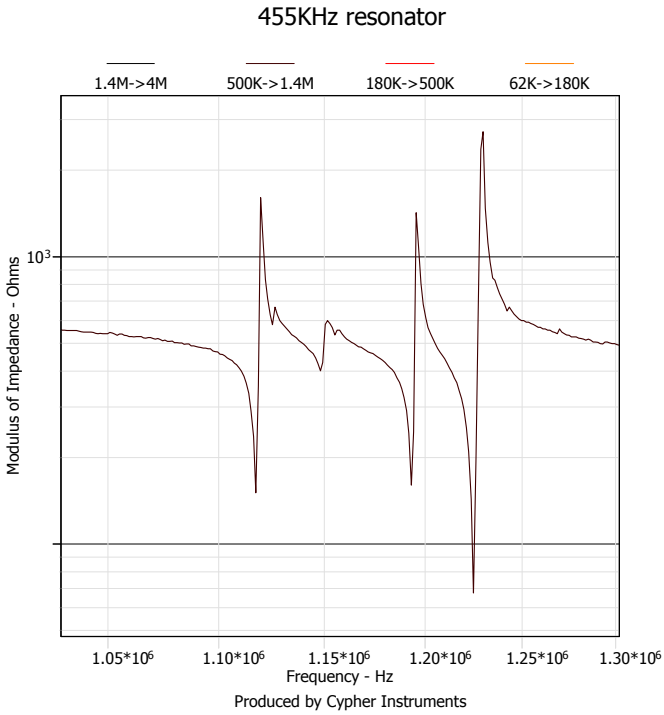

Figure 4. Resonance above 1.1MHz

The phase response shows classic phase loops that occur at these resonances. At the fundamental resonance, the phase performs an almost 'square' transition, which is shown below in more detail.

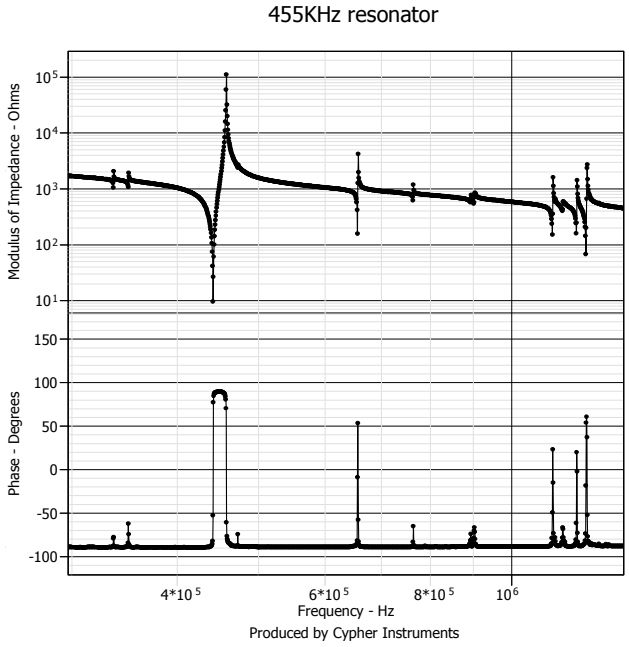

Figure 5. Phase loops at resonance

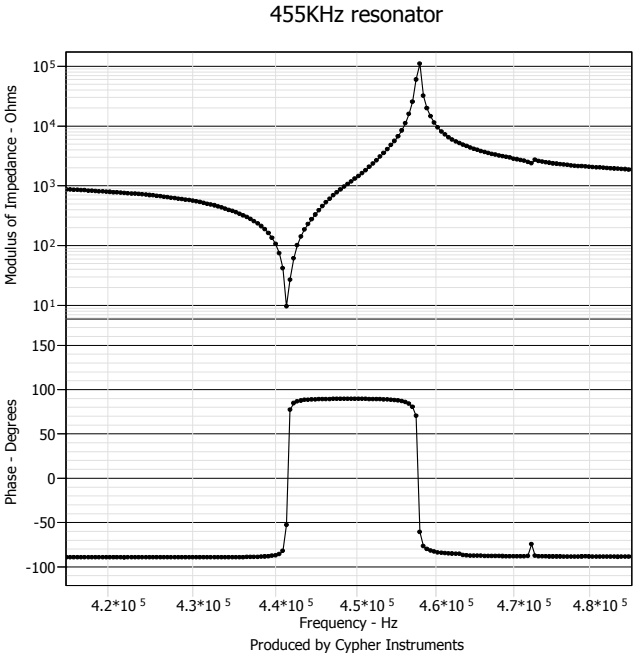

Figure 6. The square phase transition