



Effects of Magnetic Fields and Power Quality on CRTs... A Complex Investigation

S&C Featured Solution: S&C's Engineering Services

Location: Midwest United States

Customer Challenge

A high-tech R&D facility was experiencing problems with several computer workstation CRT monitors, located in various areas of their new office complex. When the monitors were placed in offices located directly behind an electrical service closet, the displays exhibited significant distortion and flicker. It was thus speculated that the root of the problem was the magnetic flux generated by the transformer in this closet. After implementing solutions suggested by the transformer manufacturer and engaging the services of an environmental consulting firm, the facility management turned over the still-unresolved issue to S&C's team of experts.

S&C Solution

S&C determined that two types of electrical phenomena could cause the interference exhibited on the CRT monitors: magnetic flux and/or power quality issues.

To check for magnetic flux interference, measurements were made using a specially designed pickup coil fed into a digital storage oscilloscope. The strength of the magnetic field was determined and measurements were made at ten different locations in the affected work area.

To check power quality, voltage measurements were taken at the utilization voltage point. Again, a digital storage oscilloscope was used to record the line-to-neutral, line-to-ground, and neutral-to-ground voltages of up to five different 120-volt circuits in the area feeding similar types of loads. The total harmonic distortion and content of the wave were analyzed at S&C using specialized computer software applying fast-Fourier transform techniques.

In addition to the tests described above, S&C developed another test to determine the sensitivity of different CRT monitors to magnetic field strength. A bulk magnetic tape eraser was used to create

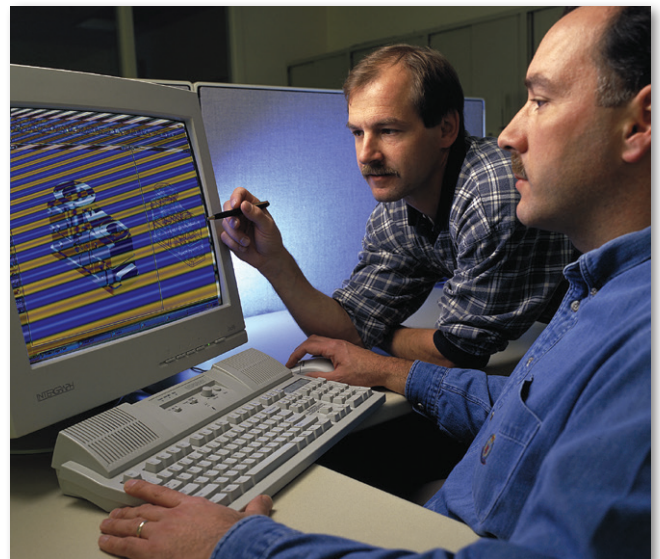
the magnetic field. By varying the distance between the monitors and the tape eraser, the effects of changing electric field strength could be measured and recorded.

Results

The magnetic field measurements were well within the threshold limit value recommended by The American Conference of Governmental Industrial Hygienists (ACGIH).

Analysis of the supply voltage indicated less than 4% total harmonic distortion in all cases. This level of voltage distortion is acceptable and would not be expected to cause problems to any connected equipment.

By testing the CRT monitors in conjunction with the bulk tape eraser, S&C ascertained that the flicker was caused by the combination of the low-magnitude magnetic field and the 60-Hz power frequency. This combination of factors interfered with the monitors, which had a screen-refresh scanning frequency setting of 76 Hz to reduce eyestrain. It was demonstrated that





by setting the screen refresh rate to match the power frequency, flicker was eliminated.

Based on the results of S&C's tests, several solutions were offered to the customer.

- The simplest solution proposed was to reset the screen refresh rate to 60 Hz. But this setting would cause eyestrain to users.
- Another solution proposed was replacement of the affected CRT monitors with LCD monitors. LCD monitors are not affected by magnetic fields.
- A third solution offered was to decrease the magnetic field strength. This option would be costly, however, and would require the use of special metal alloy shielding for the electrical service closet and/or the CRTs.

S&C's thorough investigation and subsequent recommendations provided a quantifiable basis by which the customer can decide the course of action.