♦ EMI NOISE-ORIGIN AND CHARACTERISTICS

Recent decades have witnessed the rapid growth of computers, business machines, industrial controls, medical electronics equipment and many other devices that utilize digital techniques. Concurrent with this growth, the problems of Electro-Magnetic Interference (EMI) found both in the equipment, causing interference to other equipment of related Emission communication, have become more severe. The frequency ranges of EMI noise are 10KHz to 30 MHz by conduction through wires and 30MHz to 1GHz by radiation.

Conducted EMI noise consists of two modes:

1. Common mode interference is EMI noise present on the line and neutral referenced to safety ground. Most noise problems are caused by common mode interference.

2. Differential mode interference is EMI noise present on the phase line referenced to the neutral. Differential mode EMI tends to decline rapidly in the building wiring.

♦ VDE

Products intended for European markets should meet the requirements devised by VDE. VDE 0243 specification limits conducted emission for computing devices and other industrial, scientific and medical equipment to two levels:

Class A:

The user has to apply for a special operating license by the BZT(the German equivalent of FCC). If the equipment moved from one location to another, the BZT must be notified

Class B:

If the equipment meets the B level, it then has general approval and no operating license is required. Most manufacturers attempt to meet Class B for marketing reasons. Conducted EMI regulated by FCC part 15 and VDE 243 are shown in the figure.

♦ LEGAL REGULATION ON CONDUCTED EMI FCC

In the US, the FCC has imposed legal regulations to control interference at its source. All computing devices, including peripherals, using digital techniques with a clock frequency greater than 10KHz must comply with FCC regulations part 15 after Oct. 1983.

The FCC had divided products into two basic categories:

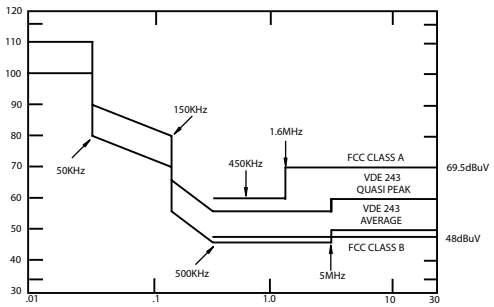
Class A:

For computing devices marketed for use in a commerical, industrial or business environment. Class A requires verification, which means that the equipment has been tested and complies with the data.

Class B:

For computing devices marketed for use in a residential environment. Class B requires certification, which means that the test data has to be submitted to FCC for the equipment to pass.

FCC Part 15/VDE 243



1. UL, CSA, VDE AND SEMKO Safety Standards

All Qualtek filters are designed to meet UL Standard 1283, CSA Standard CS22.2 No. 0, No. 8, and VDE Standard EN60939-2, including conformity to temperature range (-25 ˚C to +100 ˚C) and full current rating usage at both 115VAC and 250 VAC. All filters are UL recognized and CSA certified and most types are VDE or SEMKO approved.

2. FCC and VDE Emission Compliance

Qualtek offers a wide range of filter characteristics, both in standard and custom form to help you meet all applicable FCC, VDE and VCCI conducted emission standards including FCC, VDE and VCCI class B requirements.

3. Construction and Design (FIG. 1)

① - Toroid cover for perfect insulation, with built-in spacers to maintain creepage distance between windings.
② - Precision balance of inductance between windings to prevent core saturation at full load.
③ - Only capacitors that comply with VDE 0565-1 are used.
④ - Low leakage current.
⑤ - Both crimped and soldered connections.
⑥ - Anti-rotation terminals to prevent open connections.
⑦ - Corrosion-proof case.

4. Quality Control

- 100% tested for Hipot, leakage current, and insertion loss.
- Less than 200 parts-per-million (ppm) defect rate.

5. Availability

Stock of standard items are available for immediate shipment to customers and distributors throughout the world.

6. Price

Qualtek filters are very competitively priced due to highly automated lines and cost-saving designs.

7. Custom Design and Testing Services

Qualtek filters are designed and tested in engineering labs and shield room facilities. These facilities allow us to design and fabricate custom filters to meet special requirements not met by standard filters and to test customers' equipment for compliance to FCC, VDE and VCCI conducted emission requirements.

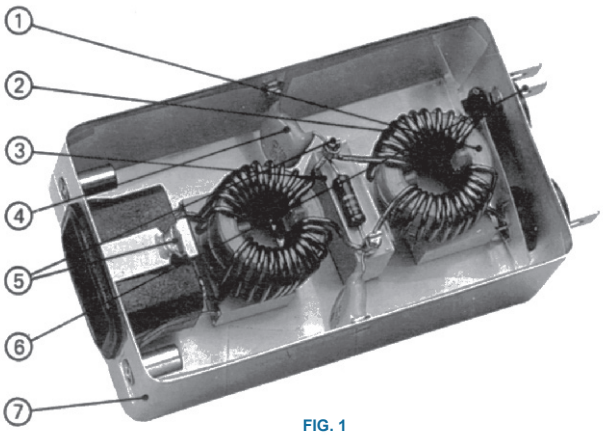


FIG. 1

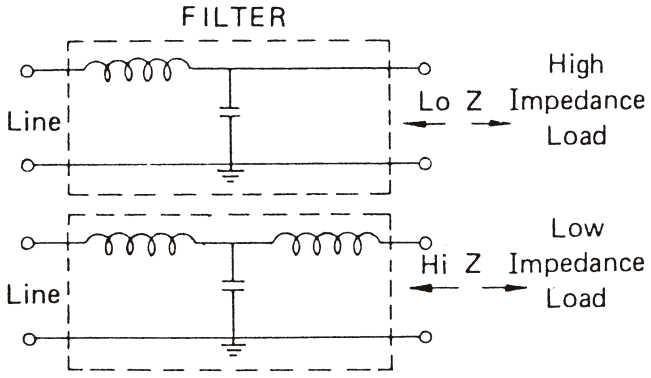
The effectiveness of noise attentuation is undoubtedly the primary concern for selecting an EMI filter. The capability in this aspec usually refers to the reading of insertion loss which is derived from the following formula:

$$\text{Insertionloss(dB)} = 20\log\frac{V1}{V2}$$

Where V1=EMI voltage without filter
V2=EMI voltage with filter

Published insertion loss data assumes that power line and load have the same impedance and all such data are in practice generated from a 50 OHM-50 OHM circuit. However, the said condition seldom exists in actual application. Therefore, insertion loss readings are not supposed to represent actual performance of noise suppression but a reference for comparison among different units or evaluation of product conformity in incoming inspection. To verify actual effectiveness in noise suppression, a filter has to be mounted in the equipment and be subjected to a conduct emission test in a shielding room.

The effectiveness of noise attenuation depends heavily on the source and load impedence. EMI filters function as "mismatching network" between source and load impedence at higher frequencies. The greater the mismatch, the more effective the filter will be in attenuating the interference. In most cases, the power line presents low impedance. The filter line side should then present high impedance. Equipment, on the other hand, can be either high or low impedance. High impedance equipment such as linear power supplies should use a filter with low impedance or a shunt capacitor at the load side to create a mismatch. Low impedance equipment such as switching power supplies, sychronous motors or shunt regulators should use a filter with high impedance at the load side and should have a series inductor. The schematics below provide an easy way for choosing the appropriate filter.



The following factors should also be taken into consideration in your selection process:

a. Current voltage rating
b. Environment requirement such as temperature, shock, vibration and humidity
c. Physical dimension and terminal configuration
d. Availability
e. Cost effectiveness
f. Safety approval

7610 Jenther Drive * Mentor, Ohio 44060
Phone: 1-440-951-3300 * Fax: 1-440-951-7252
E-Mail: mailbox@qualtekusa.com