CONDUCTED AND RADIATED EMISSIONS DESIGN REQUIREMENTS

Practice:

Initially, the design requirements for each subsystem are established so that all non-functional emissions will be at least 9 Db below the emission specification limit.

Benefits:

By initially selecting a 9 Db margin, the probability of complying with the electromagnetic compatibility (EMC) specification during system test is high.

Programs That Certified Usage:

Voyager, Magellan, Galileo, and Ocean Topographic Experiment (TOPEX)

Center to Contact for Information:

Jet Propulsion Laboratory (JPL)

Implementation Method:

Radiated and conducted emission specifications established for the customer are based on overall theoretical requirements which will meet the system specifications. The following design practices for subsystems allow for measurement error, combined effects, and manufacturing tolerance. This assures that an adequate margin will be realized when the final system performance is evaluated.

In those cases where an outside agency imposes the allowable emissions levels, the included margins must be taken into consideration so that excessive constraints are not applied. When a specific requirement is identified as a major cost driver for design, margin allocations should be reviewed for possible relief.

Conducted Emissions:

Out-of-specification conducted emission on power, control, and signal lines can usually be controlled by a low-pass filter to reduce or eliminate unnecessary high-order harmonics. On digital circuits, a compromise must be made between the need for square pulses and the suppression of high-order harmonics.

Radiated Emissions:

Radiated emission can be reduced by cancellation, cross polarization, or by either magnetic or electric field shielding.

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In some cases, radiated emission can be reduced by using a balanced design so that the external magnetic or electric fields are cancelled or cross-polarized at a particular sensor.

Shielding can be added if the additional weight can be tolerated. Otherwise, increasing the separation distance between the emitter and a sensor may be adequate.

Low frequency magnetic and electric field emissions must consider the inverse cube relation between amplitude and the separation between source and sensor in order to determine an adequate separation.

Technical Rationale:

By allowing a 9 Db margin at the design phase, there is sufficient tolerance to provide a high degree of confidence that the equipment will pass the system EMC tests. 9 Db is needed to account for the differences between idealized theory and practice plus the test margin. The test margin covers both manufacturing tolerance and measurement tolerance.

Impact of Non-Practice:

Out-of-specification performance may occur during system EMC tests. The risk of higher cost and the impact on the schedule, late in the program, must be weighed against the cost of providing a reasonable design margin during the design phase of a program.