Fischer Custom Communications, Inc.

BULK CURRENT INJECTION PROBES

Fischer Custom Communications, Inc.

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Fischer Custom Communications, Inc. develops and manufactures CW injection probes. Over 35 injection probes have been developed to meet specific customer and compliance testing requirements. Fischer Custom Communications, Inc. injection probes are currently being used for compliance testing in accord with Mil-Std-461, RTCA/DO-160 Section 20 and 22, Bellcore TR-NWT-001089, EN61000-4-6, ISO 11452-4, Def-Stan 59-41 and CSEFA-2 Euro-Fighter and other susceptibility specifications.

APPLICATIONS

Bulk current injection (BCI) methods are used to evaluate electromagnetic susceptibility of a wide range of electronic devices including automotive, avionics, computing, medical and telecommunications equipment. During normal operation of the equipment under test. These conductors include the signal, control and power circuits of equipment being evaluated.

Bulk current injection conducted immunity test methods use RF transformers to inductively couple large RF currents into conductors linking parts of electronic systems. The injection probe acts as a multiple or single primary winding and the line or circuit under test acts as a secondary winding. Injection probes can be used over the entire frequency shown in the insertion loss curve accompanying each unit.

There are three benefits for performing compliance testing using bulk current injection. The primary benefit is that BCI test results correlate well with radiated susceptibility test results. The design engineer can evaluate the affect of injected currents on the “System” or “Subsystem” under development and the relative immunity of different designs at the prototype stage of equipment development saving significant redesign time and cost. Third, conducted immunity testing can function as an integral part of a production quality assurance program. Quality assurance engineers can use BCI to perform conducted immunity tests on 100% of all critical circuits ensuring a high level of system compliance.

CHOOSING A BULK CURRRENT INJECTION PROBE

Bandwidth, efficiency, CW power rating, and the physical dimensions are the key parameters to be considered.

The most important mechanical parameter is the size of the internal diameter or injecting “window”. The internal diameter must be able to accommodate the size of the circuit under test including cable looms as well as individual cables. Fischer Custom Communications, Inc. offers clamp-on injection probes with internal diameters ranging from 32mm to 66mm. Injection probes with an internal diameter of 40mm can be used with signal and power cables of most commercial electronic equipment and systems. Injection probes with internal diameters of 66mm are ideally suited for military and avionics equipment having large signal and power cable “looms”. Custom designs having larger than 66mm internal diameter are available.

The external dimensions of the injection probe become important if the probe must be placed inside the equipment under test like a motor vehicle or aircraft.

The useable or operational bandwidth of the injection probe must overlap the frequency range under evaluation. When conducting tests in accord with RTCA/DO-160 Section 20, the useable bandwidth of the injection probe must be 10 kHz – 400 MHz. Two injection probes are required to inject the specified current over the entire range.

The effectiveness of the injection probe over the operational bandwidth is determined by the probe's efficiency. The efficiency of the injection probe is a function of the attenuation or insertion loss. The insertion loss is the ratio in dB of the amplifier forward power to the power delivered by the injection probe to a calibration fixture and its loop inductance. To inject large CW currents with small amounts of amplifier power, the injection probe must have a low attenuation. Injection of small currents requires lower levels of efficiency. Each Fischer Custom Communications injection probe comes with a serialized calibration chart.

The CW power rating of injection probes influences the effectiveness of the probe's operation. Each probe has limitations on power handling capability. The probe's rating should be higher than the power required to inject the specified current. Fisher Custom Communications offers injection probes with CW power ratings ranging from 50 to 750 watts CW. Fischer Custom Communications injection probes can operate at the rated CW power level for a minimum of 30 minutes.

MATCHING NETWORKS

Fischer Custom Communications offers impedance matching networks to increase the efficiency and bandwidth of several injection probe models. The matching network is a transformer which changes the impedance of the probe from its original value to a nominal 50Ω resulting in a more efficient transfer of power from the amplifier to the probe.

The benefit of the matching network is to reduce the amount of power required to inject the specified current level over the bandwidth under test permitting the probe to operate cooler for longer periods of time. This lower power allows the test engineer to use a broad range of amplifiers.

Each injection probe can be used with or without the matching network.

INJECTION PROBE CALIBRAION

Each injection probe is calibrated over the entire operating frequency range. The calibration plot is smoothed to within ±0.5 dB of the actual measured data. Insertion loss curves shown in this catalog are the result of insertion loss measurement of injection probe when calibrated into a 100Ω loop impedance. Mil-Std 461/462, Rev D and DO-160 Section 20 and most other BCI specifications require this loop impedance as part of calibration and test procedure. Only IEC-801.6 requires a 300Ω loop impedance. Insertion loss curves for injection probes calibrated into 300Ω loop impedances are available upon request.