AETECHRON®

APPLICATION NOTE

Automating Ripple Injection for DO-160G Section 18 Testing

AE TECHRON: ADVANCING TEST EFFICIENCY AND RELIABILITY IN AEROSPACE STANDARDS COMPLIANCE

INTRODUCTION

DO-160G Section 18 (Aircraft Power Input) specifies testing for conducted ripple injection on Aircraft Flight Control Systems (AFCS). This standard requires ripple to be applied across a wide frequency band, 100 Hz to 150 kHz, to simulate real-world electrical disturbances on power buses. A common method of ripple injection uses a coupling transformer to superimpose AC ripple onto a DC or AC bus driving the Device Under Test (DUT).

While this setup is widely accepted, it introduces non-linearities and frequency-dependent behavior due to the inherent characteristics of transformers. This application note discusses the challenges of transformer-based ripple injection and presents AE Techron's automated closed-loop compensation solution

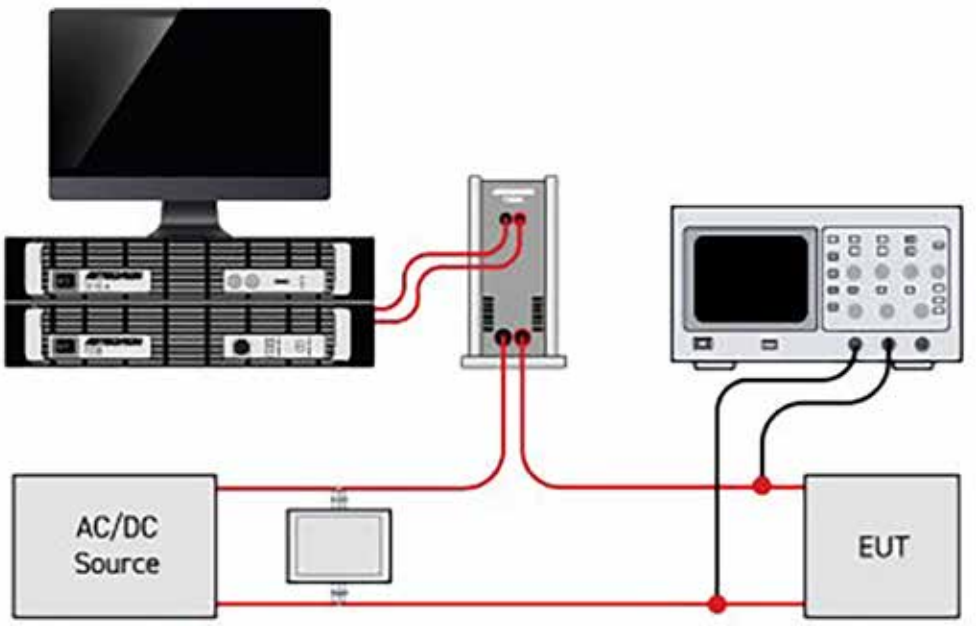

Figure 1: Simplified Section 18 Test Setup with Coupling Transformer

PROBLEM STATEMENT: TRANSFORMER LIMITATIONS

Transformers are bandpass devices. By design:

- At low frequencies (near 100 Hz), the transformer's primary inductance restricts ripple transmission.
- At high frequencies (approaching 150 kHz), leakage inductance and inter-winding capacitance distort the response.
- Only within a mid-band region does the transformer behave close to its nominal step-down ratio (e.g., 2:1).

Because of this, the ripple voltage imposed on the DUT varies significantly with frequency, fails to track the required amplitude without manual adjustment, and requires operators to repeatedly measure, adjust amplifier gain, and re-measure at each test frequency.

Traditionally, users have had to manually measure and adjust amplifier gain at each test frequency to ensure the imposed ripple meets the required standards—a time-consuming and operator-dependent process. This manual aspect can add hours to Sec. 18 or MIL-STD 461 (CS101) testing.

AE TECHRON'S CLOSED-LOOP SOLUTION: AUTOMATED LEVEL CONTROL (ALC)

AE Techron has developed an automated closed-loop compensation system (ALC) that eliminates the need for manual adjustment. This innovation places the transformer + DUT input network inside a feedback control loop.

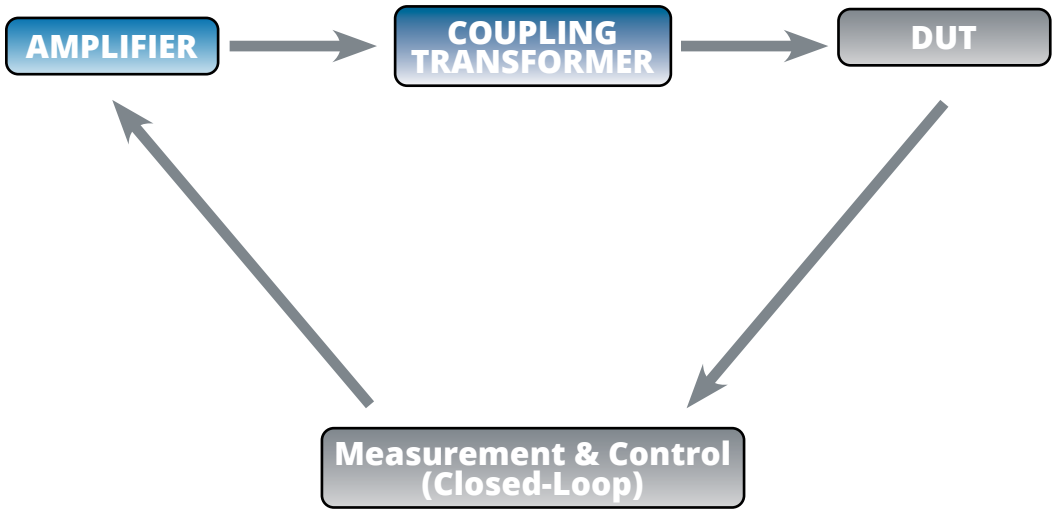

Figure 2: Closed-Loop Compensation System

HOW IT WORKS

1. **Measurement:** The system continuously monitors the actual ripple voltage being applied to the DUT.
2. **Comparison:** It evaluates the measured value against the DO-160G required ripple level at that frequency.
3. **Compensation:** The amplifier gain is automatically adjusted in real time, correcting for transformer non-linearity and frequency roll-off.

This ensures flat, standard-compliant ripple amplitude across the full test band, automatic adaptation to transformer characteristics without operator intervention, and reliable, repeatable results even across multiple DUTs or test campaigns.

KEY BENEFITS OF THE CLOSED-LOOP APPROACH

- Fully automated amplitude determination – no manual tuning required.
- FFT-based ripple voltage analysis for high accuracy.
- Adaptive impedance sensing prevents overtesting.
- Efficiency: Eliminates iterative measure-and-adjust cycles, reducing total test time.
- Repeatability: Standardized results independent of operator skill or interpretation.
- Scalability: Ideal for labs performing frequent Section 18 testing, enabling high throughput without sacrificing compliance.

CONCLUSION

DO-160G Section 18 ripple injection testing presents a unique challenge due to the bandpass nature of coupling transformers. Traditionally, operators are forced to manually compensate for transformer non-linearities to ensure compliance. AE Techron's closed-loop ripple compensation system automates this process, delivering accuracy, efficiency, and repeatability unmatched by manual methods. For Section 18 compliance testing, this solution allows laboratories to streamline operations, reduce risk, and confidently demonstrate adherence to DO-160G requirements.