

## Common Features:

- Comprehensive Test coverage for Commercial and Military Aviation & Shipboard Compliance Test
- Test Report Generation Included to Meet Documentation Requirements
- Easy Customization of Provided Test Sequence Files Allows Greater Test Flexibility
- Ability to Integrate External Test and Measurement Equipment into Test Sequences Using Powerful VB Scripting Tools and VISA Drivers
- Runs Inside Pacific Power Source's Windows 10 Test Manager Software (*Test Manager License Required*)

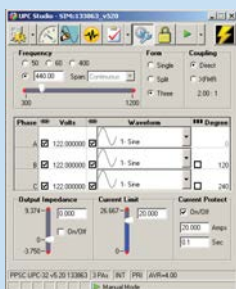
## Available Test Standards:

- Airbus ABD0100.1.8 (A380)
- Airbus ABD0100.1.8.1 (A350)
- Airbus AMD24C (A400M)
- Boeing 787B3-0147 (787)
- RTCA/DO-160, Section 16
- MIL-STD 704
- MIL-STD 1399-300, Rev B & Part 1

Contact Pacific Power Source for availability of other Avionics test standard options.

## Test Manager Software Suite *Master the Power of the Wave!*

Test Manager Software gives you the tools necessary to quickly and easily operate your AC and DC Power Source. With our graphical interface control all areas of your AC Power Source testing with simple presets, user prompts, Test Sequences, test plans and custom reports.



## Avionics & Shipboard Power Compliance Testing

All electrical equipment installed on commercial and military airframes must comply with regulatory power immunity standards to ensure safe operation of the aircraft. These standard can be divided into generic test standards or manufacturer specific test standards. Generic standards such as MIL-STD 704 are typically issued by either a government body such as the Department of Defense (DoD) or by a private enterprise in close cooperation with a government entity such as the Federal Aviation Administration (RTCA/DO160 test standard).

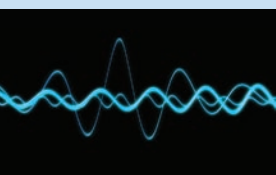
Manufacturer specific avionics test standards are generally based on an industry standard with specific variations and modifications deemed necessary by the manufacturer, in order to qualify equipment for suitability of use on its aircraft. Examples of some of these manufacturers are Airbus, Beechcraft, Boeing, Bombardier, Canadair, COMAC, Embraer, Gulfstream and Learjet. Airbus ABD0100.8.1 and Boeing 787-B3-0147 are manufacturer specific test standards.

All these test standards require application of power conditions and anomalies that can occur on the AC or DC power bus during aircraft operation. The fundamental AC frequency used during these tests is either 60Hz or 400Hz (fixed frequency) or ranges between 360Hz and 800Hz (wild frequency).

## Available Compliance Test Standard Options

Manufacturer / Organization	Test Standard	Airframe	Revision	PPS Part Number
Airbus Industries, Europe	ABD0100.1.8	A380	E	149102
	ABD0100.1.8.1	A350	C	149125
	AMD24C	A400M	C	149127
Boeing, USA	787B3-0147	787 Dreamliner	C	149126
Radio Technical Commission for Aeronautics (RTCA)	DO160, Section 16	Commercial Aviation	G	149124
US Department of Defense (DoD)	MIL-STD-704	Military Aviation	A	149112
			F	149101
US Department of Defense (DoD)	MIL-STD-1399-300	Navy	B	149130
			Part 1	149132

Support for other avionics standards and revisions are being developed on an on-going basis so check with your local representative for up to date information on availability of test standards not listed in this data sheet.



FREQUENCY CONVERSION



AEROSPACE



R & D



MILITARY



MANUFACTURING

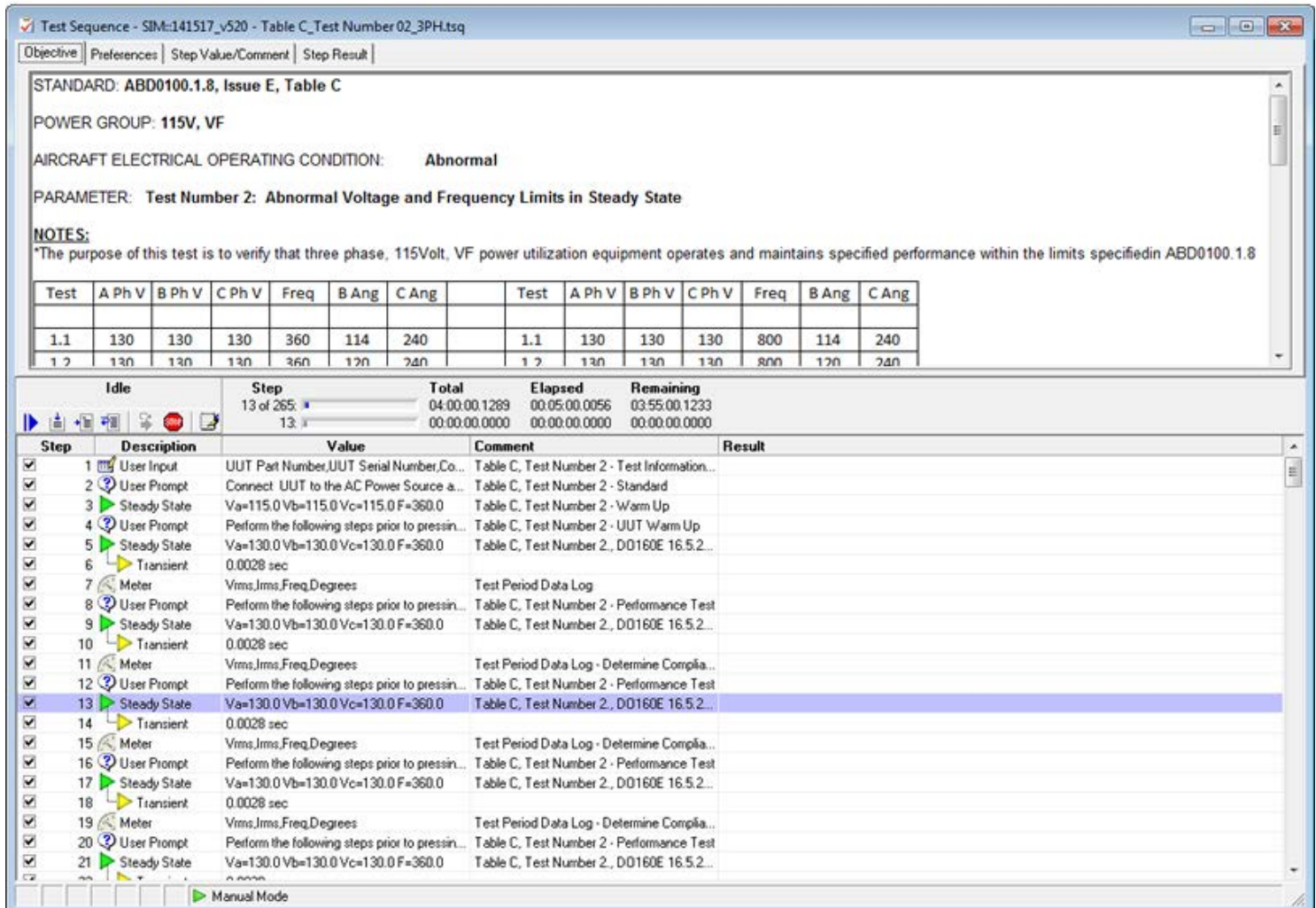


CUSTOM

## Test Executive

Rather than being fixed with no ability for customization or enhancements, Pacific Power Source's Test Sequences are developed within its UPC Test Manager and PPSC Test Manager test executive environments. Test Manager is a plug-in to the standard Pacific Power Source UPC Studio or PPCS Manager windows software and provides complete access to the underlying Test Sequence implementation.

It also provides powerful tools for controlling test execution, collecting measurement data from the AC Power Source and or the unit under test and integration of other aspects of compliance testing such as temperature environment control capability into provided test routines.



Test Sequence - SIM:141517\_v520 - Table C\_Test Number 02\_3PH.tsq

Objective | Preferences | Step Value/Comment | Step Result

STANDARD: ABD0100.1.8, Issue E, Table C

POWER GROUP: 115V, VF

AIRCRAFT ELECTRICAL OPERATING CONDITION: **Abnormal**

PARAMETER: Test Number 2: Abnormal Voltage and Frequency Limits in Steady State

NOTES:  
\*The purpose of this test is to verify that three phase, 115Volt, VF power utilization equipment operates and maintains specified performance within the limits specified in ABD0100.1.8

Test	A Ph V	B Ph V	C Ph V	Freq	B Ang	C Ang	Test	A Ph V	B Ph V	C Ph V	Freq	B Ang	C Ang
1.1	130	130	130	360	114	240	1.1	130	130	130	800	114	240
1.2	130	130	130	360	120	240	1.2	130	130	130	800	120	240

Idle Step 13 of 265: 13. Total 04:00:00.1289 Elapsed 00:05:00.0056 Remaining 03:55:00.1233

Step	Description	Value	Comment	Result
1	User Input	UUT Part Number,UUT Serial Number,Co...	Table C, Test Number 2 - Test Information...	
2	User Prompt	Connect UUT to the AC Power Source a...	Table C, Test Number 2 - Standard	
3	Steady State	Va=115.0 Vb=115.0 Vc=115.0 F=360.0	Table C, Test Number 2 - Warm Up	
4	User Prompt	Perform the following steps prior to pressin...	Table C, Test Number 2 - UUT Warm Up	
5	Steady State	Va=130.0 Vb=130.0 Vc=130.0 F=360.0	Table C, Test Number 2, D0160E 16.5.2...	
6	Transient	0.0028 sec		
7	Meter	Vrms,Irms,Freq,Degrees	Test Period Data Log	
8	User Prompt	Perform the following steps prior to pressin...	Table C, Test Number 2 - Performance Test	
9	Steady State	Va=130.0 Vb=130.0 Vc=130.0 F=360.0	Table C, Test Number 2, D0160E 16.5.2...	
10	Transient	0.0028 sec		
11	Meter	Vrms,Irms,Freq,Degrees	Test Period Data Log - Determine Compla...	
12	User Prompt	Perform the following steps prior to pressin...	Table C, Test Number 2 - Performance Test	
13	Steady State	Va=130.0 Vb=130.0 Vc=130.0 F=360.0	Table C, Test Number 2, D0160E 16.5.2...	
14	Transient	0.0028 sec		
15	Meter	Vrms,Irms,Freq,Degrees	Test Period Data Log - Determine Compla...	
16	User Prompt	Perform the following steps prior to pressin...	Table C, Test Number 2 - Performance Test	
17	Steady State	Va=130.0 Vb=130.0 Vc=130.0 F=360.0	Table C, Test Number 2, D0160E 16.5.2...	
18	Transient	0.0028 sec		
19	Meter	Vrms,Irms,Freq,Degrees	Test Period Data Log - Determine Compla...	
20	User Prompt	Perform the following steps prior to pressin...	Table C, Test Number 2 - Performance Test	
21	Steady State	Va=130.0 Vb=130.0 Vc=130.0 F=360.0	Table C, Test Number 2, D0160E 16.5.2...	

Manual Mode

Other instruments can be controlled through the UPC Studio executive using VISA drivers and VB Scripting, thus providing powerful tools to test engineers. Alternatively, the Test Sequences can be ran as provided, controlling just the Pacific Power Source AC Source with no further customization required.

Test Sequence libraries can be password protected by the user to prevent unauthorized modifications. Revision control of test procedures is built into the Test Manager executive.



## Airbus ABD0100.1.8(A380)

### Scope

The Airbus standard no. 100, Part 1, Chapter 8 (ABD0100.1.8) General Requirement for Suppliers is largely based on the RTCA/DO-160, Section 16 commercial aviation test standard. The ABD0100.1.8 standard is intended to ensure that electrical equipment connected to the AC or DC power bus of the Airbus A380 behaves in a predictable and safe way.

The ABD0100.1.8 standard covers both AC and DC power buses as well as Dielectric and Insulation Resistance test requirements. The Pacific Power Source ABD0100.1.8 test option covers all AC power groups contained in the test standard as shown in the table below.

### Supported Power Groups

The following test tables are included in the ABD0100.1.8 test option. DC tests require AFX Series.

Power Group	Description	Nominal Voltage	Nominal Frequency	Phase Modes
Table A	AC Power, Constant Frequency	115Vrms L-N	400Hz	1 Phase and 3 Phase
Table B	AC Power, Constant Frequency	26Vrms L-N	400Hz	
Table C	AC Power, Wide Variable Frequency	115Vrms L-N	360 – 800Hz	
Table D	Conventional DC Power Test	28 Vdc	n/a	n/a
Table E	NBPT <sup>1</sup> DC Power Test	28 Vdc	n/a	n/a

### AC Power Test Execution Samples – ABD0100.1.8

The following screens provide some typical captured output voltage waveforms from the AC Power Source during

ing ABD0100.1.8 AC Test Sequence execution. Samples shown reflect two different test conditions on a three phase 115VLN/200VLL AC power bus.

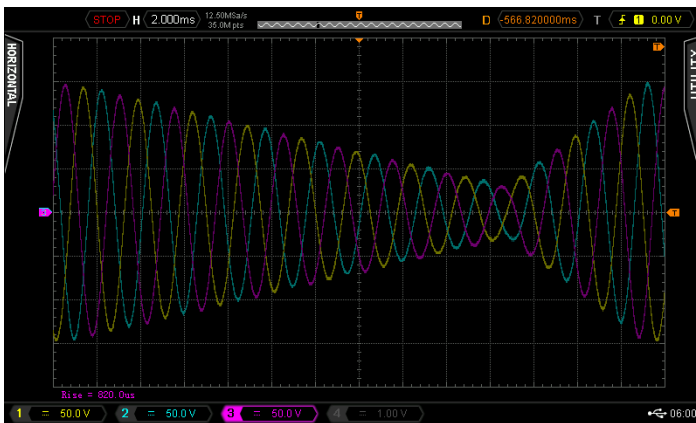


Figure 1: ABD0100.1.8 A380 Table A, Test Number 6, Three Phase Voltage Transient – short duration

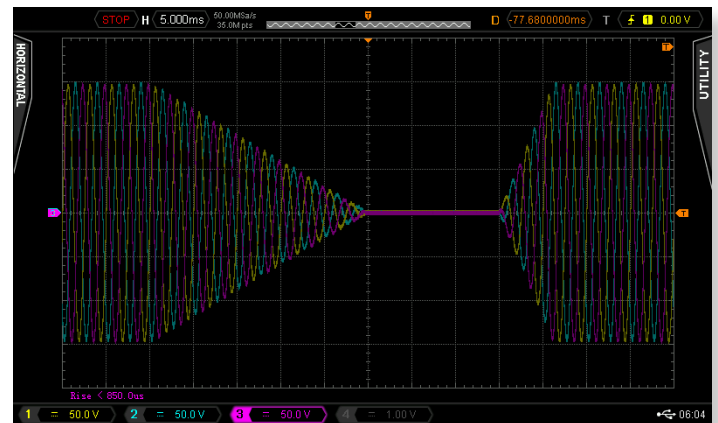


Figure 2: ABD0100.1.8 A380 Table A, Test Number 6, Three Phase Voltage Transient – long duration

### DC Power Test Execution Samples – ABD0100.1.8

The following screens provide some typical captured output voltage waveforms from the DC Power Source during

ABD0100.1.8 DC Test Sequence execution. Samples shown reflect two different test conditions, DC transient (Figure 3) and Load Square DC pulse (Figure 4).

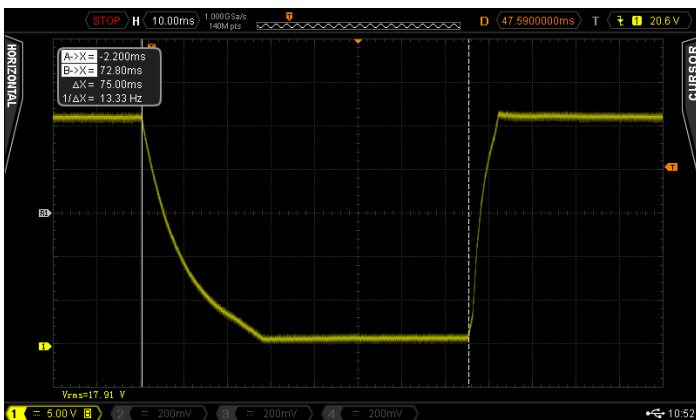


Figure 3: ABD0100.1.8E DC Table D, Test 6 per Fig 1.2 Voltage Transient

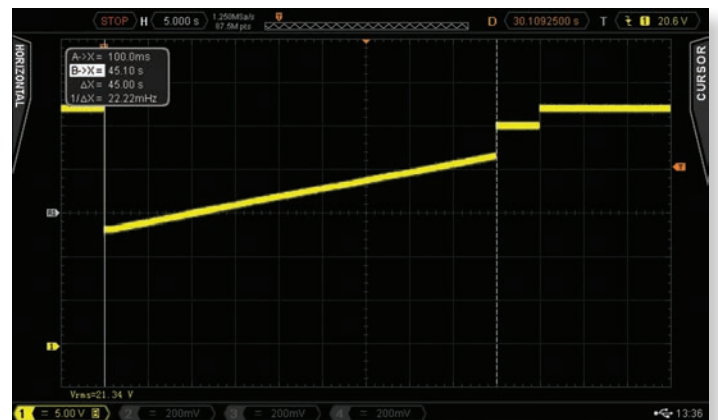


Figure 4: ABD0100.1.8E Table D, Test 7, A380 Heavy Load square DC pulse

## Compliance Matrix ABD0100.1.8(A380)

The ABD0100.1.8 option supports all AC and DC power related tests that fall within the performance envelope of the power source model used. For optimal AC only performance, the LMX Series is recommended. For AC and DC requirements, the AFX Series is required. Note that the ABD test software will allow acquisition of measurement data during the test execution but additional external test equipment is generally required as well to monitor EUT performance. The compliance matrix shown here applies to the stimulus requirement of the test standard only.

The table below describes the available test coverage for each section of the test standard. Paragraph numbers shown refer to the relevant part of the standard document.

Table	Test No.	Description	Vnom	Freq	1 Phs	3 Phs	Notes
A	1	Steady state voltage and frequency: normal & emergency operation	115Vac	400Hz	Y	Y	
	2	Steady state voltage and frequency: abnormal operation			Y	Y	
	3	Voltage surge: normal transients			Y	Y	
	4	Voltage surge: abnormal transients			Y	Y	
	5	Voltage spikes			R	R	Requires spike generator and coupling network
	6	Switching transients			Y	Y	
	7	Voltage modulation			Y	Y	
	8	Frequency excursions in abnormal operation			Y	Y	
	9	Frequency modulation			Y	Y	
	10	Distorted voltage			Y	Y	
	11	Voltage DC content			Y	Y	
Table	Test No.	Description	Vnom	Freq	1 Phs	3 Phs	Notes
B	1	Steady state voltage and frequency: normal & emergency operation	26Vac	400Hz CF	Y	N/A	
	2	Steady state voltage and frequency: abnormal operation			Y	N/A	
	3	Voltage surge: normal transients			Y	N/A	
	4	Voltage surge: abnormal transients			Y	N/A	
	5	Voltage spikes			R	N/A	Requires spike generator and coupling network
	6	Switching transients			Y	N/A	
	7	Voltage modulation			Y	N/A	
	8	Frequency excursions in abnormal operation			Y	N/A	
	9	Frequency modulation			Y	N/A	
	10	Distorted voltage			Y	N/A	
	11	Voltage DC content			Y	N/A	
Table	Test No.	Description	Vnom	Freq	1 Phs	3 Phs	Notes
C	1	Steady state voltage and frequency: normal & emergency operation	115Vac	360 - 800Hz VF	Y	Y	
	2	Steady state voltage and frequency: abnormal operation			Y	Y	
	3	Voltage surge: normal transients			Y	Y	
	4	Voltage surge: abnormal transients			Y	Y	
	5	Voltage spikes			R	R	Requires spike generator and coupling network
	6	Switching transients			Y	Y	
	7	Voltage modulation			Y	Y	
	8	Frequency excursions in abnormal operation			Y	Y	
	9	Frequency modulation			Y	Y	
	10	Distorted voltage			Y	Y	
	11	Voltage DC content			Y	Y	
Table	Test No.	Description	Vnom	Freq	1 O/P	3 O/P	Notes
D	1	Steady state voltage and frequency: normal & emergency operation	28Vdc	n/a	Y	Y	
	2	Steady state voltage and frequency: abnormal operation			Y	Y	
	3	Voltage surge: normal transients			Y	Y	
	4	Voltage surge: abnormal transients			Y	Y	
	5	Voltage spikes			R	R	Requires spike generator and coupling network
	6	Switching transients			Y	Y	
	7	Square waves due to large load variations in normal conditions			Y	Y	
	8	Ripple voltage			R	R	Up to 20kHz AC ripple
Table	Test No.	Description	Vnom	Freq	1 O/P	3 O/P	Notes
E	1	Steady state voltage and frequency: normal, abnormal & emergency operation	28Vdc NBPT	n/a	Y	Y	
	2	Voltage surge: normal transients			Y	Y	
	3	Voltage surge: abnormal transients			Y	Y	
	4	Voltage spikes			R	R	Requires spike generator and coupling network
	5	Switching transients			Y	Y	
	6	Ripple voltage			R	R	Up to 20kHz AC ripple

Notes: Y = Full support. No additional equipment is needed to perform the required AC stimulus  
 R = Requires additional equipment. Refer to actual Test Standard Documents for details.  
 N = Not supported

N/A = Not Applicable - No Test required  
 NBPT = No Break Power Transfer DC network  
 DC Tests Table D & E are provided in both single or three phase mode versions

## Airbus ABD0100.1.8.1(A350)

### Scope

The Airbus standard no. 100, Part 1, Chapter 8, Section 1 (ABD0100.1.8.1) General Requirement for Suppliers is largely based on the RTCA/DO-160, Section 16 commercial aviation test standard. It is also closely related to the ABD0100.1.8 test standard. The ABD0100.1.8.1 is intended to ensure that electrical equipment connected to the AC power bus of the Airbus A350 behaves in a predictable and safe way.

The ABD0100.1.8.1 standard covers both AC and DC power buses as well as Dielectric and Insulation Resistance test requirements. The Pacific Power Source ABD0100.1.8.1 test option covers all AC power groups contained in the test standard as shown in the table below.

### Supported Power Groups - AC

The following power groups are included in the ABD0100.1.8.1(A350) test option.

Power Group	Description	Nominal Voltage	Nominal Frequency	Phase Modes	ABD0100.8.1 Table
SVF	Single-Phase, Variable Frequency, 115 V	115Vrms L-N	360 – 800Hz	Single Phase	C.3
TVF	Three-Phase, Variable Frequency, 115 V	115Vrms L-N	360 – 800Hz	Three Phase	C.4
SVFH	Single-Phase, Variable Frequency, 230 V	230Vrms L-N	360 – 800Hz	Single Phase	C.5
TVFH	Three-Phase, Variable Frequency, 230 V	230Vrms L-N	360 – 800Hz	Three Phase	C.6
SCF	Single-Phase, 400 Hz Constant Frequency, 115 V	115Vrms L-N	400Hz	Single Phase	C.7
TCF	Three-Phase, 400 Hz Constant Frequency, 115 V	115Vrms L-N	400Hz	Three Phase	C.8
SCFH	Single-Phase, 400 Hz Constant Frequency, 230 V	230Vrms L-N	400Hz	Single Phase	C.9
TCFH	Three-Phase, 400 Hz Constant Frequency, 230 V	230Vrms L-N	400Hz	Three Phase	C.10

### Test Execution Samples – ABD0100.1.8.1(A350)

The following screens provide some typical captured output voltage waveforms from the AC Power Source during Airbus ABD0100.1.8.1 Test Sequence execution. Samples shown reflect two different test conditions from Power Group TCF (Three phase, fixed frequency), test TCF102 – Voltage Transients - and Test TCF201 – Abnormal Steady State Voltage and Frequency.

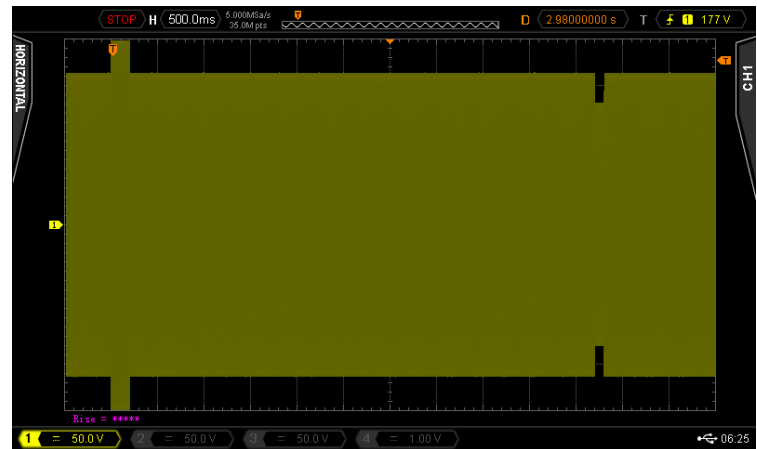


Figure 5: ABD0100.1.8.1 A350 Voltage Transient Test TCF102, 5 second intervals

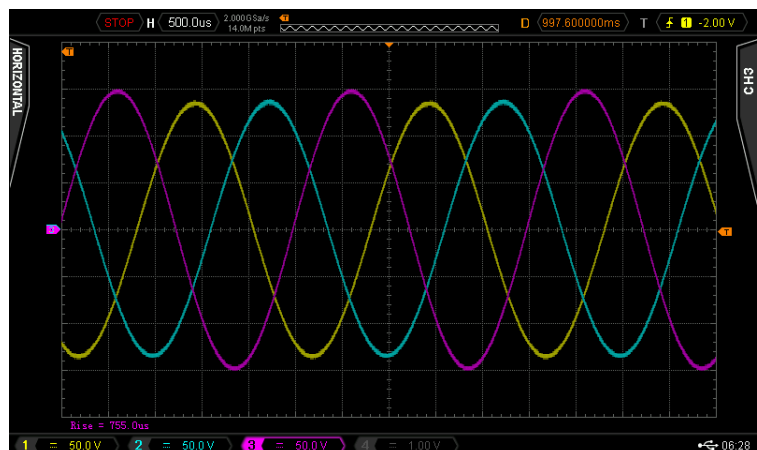


Figure 6: ABD0100.1.8.1 A350 Abnormal Voltage and Frequency Test TCF201.

## Compliance Matrix ABD0100.1.8.1(A350)

Test	Description	SVF	TVF	SVFH	TVFH	SCF	TCF	SCFH	TCFH	Notes
VF	CF									
Normal Operation (1xx)										
101		Steady State Voltage and Frequency	Y	Y	Y	Y	Y	Y	Y	
102		Voltage Transients	Y	Y	Y	Y	Y	Y	Y	High voltage spikes up to 160V or 324V requires Split Phase mode (FORM2) or Transformer (XFMR) for Single Phase, and Transformer(XFMR) for Three Phase UUT's
103		Voltage Modulation	Y	Y	Y	Y	Y	Y	Y	
104		Voltage Spikes	R	R	R	R	R	R	R	Requires external Spike Generator with 1000V pos/neg capability
105		Current Distortion	R	R	R	R	R	R	R	Requires Spectrum Analyzer and CT's to monitor UUT current
106		Voltage Distortion 1	Y	Y	Y	Y	Y	Y	Y	Requires adjustable full- bridge rectifier load
107		Voltage Distortion 2	R	R	R	R	R	R	R	Requires External Signal Generator and Coupling Transformer
108		Voltage Distortion Transients	Y	Y	Y	Y	Y	Y	Y	Requires adjustable full- bridge rectifier load
109		Inrush Current	R, Z	R, Z	R, Z	R, Z	R, Z	R, Z	R, Z	Requires measurement equipment to measure inrush current. May require special input cabling to meet impedance requirements
110		Frequency Variations	Y	Y	Y	Y				
111	110	Frequency Modulation	Y	Y	Y	Y	Y	Y	Y	
112	111	Voltage DC Content	R	R	R	R	R	R	R	Requires AFX Series
113	112	Voltage Modulation due to Equipment	R	R	R	R	R	R	R	May require special input cabling to meet impedance requirements
114	113	Voltage Spike due to Equip. Load Switching	R	R	R	R	R	R	R	Requires contactor/relay switching between AC Source and UUT
115	114	Voltage Unbalance Transient	N/A	Y	N/A	Y	N/A	Y	N/A	
Adnormal Operation (2xx)										
201		Steady State Voltage and Frequency	Y	Y	Y	Y	Y	Y	Y	
202		Voltage Transients	Y	Y	Y	Y	Y	Y	Y	High voltage spikes up to 180V or 360V requires Split Phase mode (FORM2) or Transformer (XFMR) for Single Phase, and Transformer(XFMR) for Three Phase UUT's
203		Voltage Modulation	Y	Y	Y	Y	Y	Y	Y	
204		Frequency Transients	Y	Y	Y	Y	Y	Y	Y	
Emergency Operation (3xx)										
301		Steady State Voltage and Frequency	Y	Y	Y	Y	Y	Y	Y	
302		Voltage Distortion	Y	Y	Y	Y	Y	Y	Y	Requires adjustable full- bridge rectifier load
303		Voltage Distortion	R	R	R	R	R	R	R	Requires External Signal Generator and Coupling Transformer
304		Voltage Distortion Transients	Y	Y	Y	Y	Y	Y	Y	Requires adjustable full- bridge rectifier load
305		Inrush Current	Y	Y	Y	Y	Y	Y	Y	Requires measurement equipment to measure inrush current. May require special input cabling to meet impedance requirements
306		Frequency Variations	Y	Y	Y	Y	Y	Y	Y	
307		Voltage Modulation due to Equipment	Y	Y	Y	Y	Y	Y	Y	May require special input cabling to meet impedance requirements
Switching Transients (4xx)										
401		Transparency Time	Y	Y	Y	Y	Y	Y	Y	
402		Voltage Switching Transients 1	Y	Y	Y	Y	Y	Y	Y	
403		Voltage Switching Transients 2, Part 1A	Y	Y	Y	Y	Y	Y	Y	
404		Voltage Switching Transients w/Freq. Change	Y	Y	Y	Y	N/A	N/A	N/A	
Power Supply Removal (5xx)										
501		Power Line Disconnection	Y	Y	Y	Y	Y	Y	Y	

DC Test <sup>1</sup>	Description	LDC	Notes	DC Test <sup>1</sup>	Description	LDC	Notes
Normal Operation (1xx)				Emergency Operation (3xx)			
101	Steady State Voltage	Y	Ext. Meas. Equipment	301	Steady State Voltage	Y	Ext. Meas. Equipment
102	Voltage Transients	Y		302	Voltage Ripple	Y	
103	Voltage Ripple	Y		303	Inrush Current	Y	Ext. Meas. Equipment
104	Voltage Spikes	Y / R	Additional Equip. Req.	304	Equipment Current Ripple	Y	Additional Equip. Req.
105	Inrush Current	Y	Ext. Meas. Equipment	Switching Transients (4xx)			
106	Voltage Variation due to APU Starting	Y		401	Transparency Time	Y	
107	Equipment Current Ripple	Y / R	Additional Equip. Req.	402	Voltage Switching Transients 1	Y	
108	Voltage Spikes due to Equipment Loads	Y / R	Additional Equip. Req.	403	Voltage Switching Transients 2	Y	
109	EPDC Voltage Clamping Devices	Y / R	Additional Equip. Req.	Power Supply Removal (5xx)			
Abnormal Operation (2xx)				501	Power Line Disconnection	Y	
201	Steady State Voltage	Y	Ext. Meas. Equipment	Note1 : All DC tests require AFX Series			
202	Voltage Transients	Y					
203	Voltage Ripple	Y					

Notes: Y = Full support. No additional equipment is needed to perform the required AC stimulus  
 R = Requires additional equipment. Refer to actual Test Standard Documents for details.  
 N = Not supported  
 N/A = Not Applicable - No Test required  
 Z = Prog-Z required

## Airbus AMD24C (A400M)

### Scope

The Airbus standard AMD24C, "Electrical characteristics of aircraft AC and DC systems" is based on similar test procedures as are outlined in the RTCA/DO-160, Section 16 commercial aviation test standard. However, test levels and applicable levels are different and unique to the Airbus AMD24C standard. The AMD24C standard is intended to ensure that electrical equipment connected to the AC power bus of the Airbus M400 military cargo plane behaves in a predictable and safe way.

This test standard covers both AC and DC<sup>1</sup> power buses. The Pacific Power Source AMD24C test option covers both AC and DC power groups contained in the test standard as shown in the table below. Some tests may require additional equipment in addition to the AC power source. Refer to compliance matrix on next page for more details.

### Supported Power Groups - AC & DC

The following power groups are included in the AMD24C (M400) test option.

Power Group	Description	Nominal Voltage	Nominal Frequency	Phase Modes	AMD24C Table
SVF	Single-Phase, Variable Frequency, 115 V	115Vrms L-N	390 – 620Hz	Single Phase	C.3
TVF	Three-Phase, Variable Frequency, 115 V	115Vrms L-N	390 – 620Hz	Three Phase	C.4
SCF	Single-Phase, Constant Frequency, 115 V	115Vrms L-N	400Hz	Single Phase	C.5
TCF	Three-Phase, Constant Frequency, 115 V	115Vrms L-N	400Hz	Three Phase	C.6
LDC	DC Voltage, 28V	28 Vdc	DC	n/a	C.7

### Test Execution Samples – AMD24C (M400)

The following screens provide some typical captured output voltage waveforms from the AC Power Source during Airbus AMD24C Test Sequence execution. Samples shown reflect two different test conditions from Power Group TVF (Three phase, variable frequency), test TCF102 – Voltage Transients - and Test TCF201 – Abnormal Steady State Voltage and Frequency.

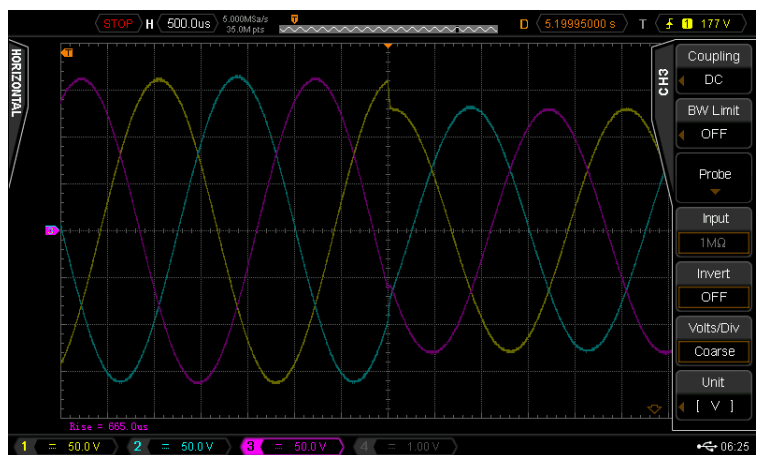


Figure 7: AMD24C Abnormal Test TCF201.

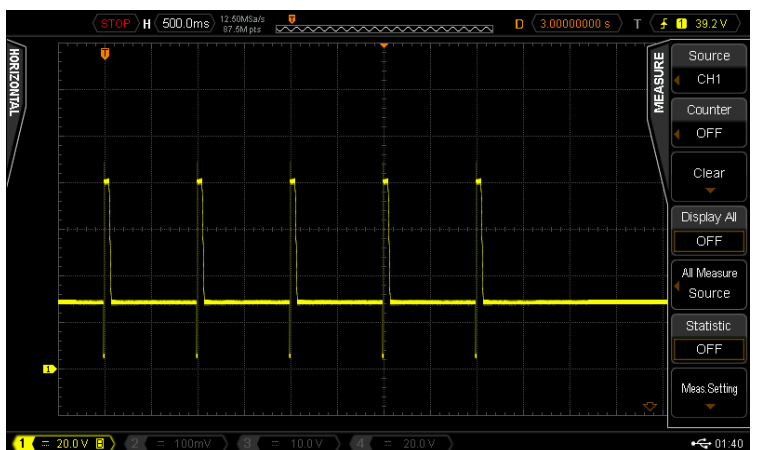


Figure 8: AMD24C LDC DC Transient Test, 5 second intervals



Note1 : All DC tests require AFX Series

## Compliance Matrix AMD24C (A400M)

Test		Description	SVF	TVF	SCF	TCF	Notes
VF	CF						
Normal Operation (1xx)							
101		Steady State Voltage and Frequency	Y	Y	Y	Y	
102		Voltage Transients	Y	Y	Y	Y	High voltage spikes up to 160V requires Split Phase mode (FORM2) or Transformer (XFMR) for Single Phase, and Transformer(XFMR) for Three Phase UUT's
103		Voltage Modulation	Y	Y	Y	Y	
104		Voltage Spikes	R	R	R	R	Requires external Spike Generator with 1000V pos/neg capability
105		Current Distortion	R	R	R	R	Requires Spectrum Analyzer and CT's to monitor UUT current
106		Voltage Distortion	Y	Y	Y	Y	Requires adjustable full- bridge rectifier load (AC)
107		Inrush Current	R, Z	R, Z	R, Z	R, Z	Requires measurement equipment to measure inrush current. May require special input cabling to meet impedance requirements
108	-	Frequency Variations	Y	Y			
109	108	Frequency Modulation	Y	Y	Y	Y	Discrete frequency steps
110	109	Voltage DC Content	R	R	R	R	Requires AFX Series
111	110	Voltage Modulation due to Equipment	R	R	R	R	May require special input cabling to meet impedance requirements
112	111	Voltage Spike due to Equip. Load Switching	R	R	R	R	Requires contactor/relay switching between AC Source and UUT
Adnormal Operation (2xx)							
201		Steady State Voltage and Frequency	Y	Y	Y	Y	
202		Voltage Transients	Y	Y	Y	Y	High voltage spikes up to 180V requires Split Phase mode (FORM2) or Transformer (XFMR) for Single Phase, and Transformer(XFMR) for Three Phase UUT's
203		Voltage Modulation	Y	Y	Y	Y	
-	204	Frequency Variations	N/A	N/A	Y	Y	
Emergency Operation (3xx)							
301	-	Steady State Voltage and Frequency	Y	Y	Y	Y	
302	-	Voltage Distortion	Y	Y	Y	Y	Requires adjustable full- bridge rectifier load (AC)
303	-	Voltage Distortion Transients	R	R	R	R	Requires adjustable full- bridge rectifier load (AC)
304	-	Frequency Variations	Y	Y	N/A	N/A	
305	-	Voltage Modulation due to Equipmnt	Y	Y	Y	Y	Requires measurement equipment to measure inrush current. May require special input cabling to meet impedance requirements
Switching Transients (4xx)							
401		Transparency Time	Y	Y	Y	Y	
402		Voltage Switching Transients 1	Y	Y	Y	Y	
403		Voltage Switching Transients 2	Y	Y	Y	Y	
404	-	Voltage Switching Transients w/Freq. Change	Y	Y	N/A	N/A	
Undervoltage Operation (5xx)							
501		Power Failure	Y	Y	Y	Y	

LDC Test <sup>1</sup>	Description	LDC	Notes	LDC Test <sup>1</sup>	Description	LDC	Notes
Normal Operation (1xx)				Emergency Operation (3xx)			
101/APU	Steady State Voltage	Y		301	Steady State Voltage	Y	
102/APU	Voltage Transients	R	AC&DC not supported	302	Voltage Ripple	Y	
103/APU	Voltage Ripple	R	Requires function generator and coupling transformer	303	Inrush Current	Y	
104	Voltage Spikes	R	Requires Spike Generator	Transfer Operation (4xx)			
105/APU	Inrush Current	Y		401/APU	Transparency Time	Y	
106	Voltage Variations due to APU start	Y		402/APU	Voltage Switching Transients 1	Y	
107	DC Ripple Voltage due to Equipment	N	Test is not supported	403/APU	Voltage Switching Transients 2	Y	
108	Voltage Spike due to Equip. Load	Y		Undervoltage Operation (5xx)			
109	Compatability with SEPDC clipping	Y		501	Power Failure	Y	
Abnormal Operation (2xx)							
201/APU	Voltage Transients	R	AC&DC not supported				

Note 1 : All DC tests require AFX Series

Notes:

- Y = Full support. No additional equipment is needed to perform the required AC stimulus
- R = Requires additional equipment. Refer to actual Test Standard Documents for details.
- N = Not supported
- N/A = Not Applicable - No Test required
- Z = Prog-Z required



## Boeing 787B3-0147 (B787)

### Scope

The Boeing Company 787B3-0147 Test Standard is generally based on the RTCA/DO-160, Section 16 commercial aviation test standard but has several additional test requirements. This standard is intended to insure that electrical equipment connected to the AC or DC power bus of the 787 Dreamliner behaves in a predictable and safe way.

The Pacific Power Source, Inc. BOEING 787B3-0147 test sequence option is based on the 787 Electrical Power Quality and Design Requirements Document revision C, and consists of test sequences for single-phase and three-phase equipment in AC power categories. This Boeing 787B3-0147 option covers AC and DC power groups as listed in the tables below.

### Supported Power Groups

The following power groups are included in the 787B3-0147 test option. Note that some tests require other equipment than just an AC or DC power source. This other equipment may not be available from Pacific Power Source.

Power Group	Description	Power Group	Description
AC	All AC Power Groups	DC	DC Power Groups, 28Vdc, $\pm 270$ Vdc, $\pm 130$ Vdc

### Compliance Matrix 787B3-0147

The Boeing 787B3-0147 option supports AC power related tests that fall within the performance envelope of the AC power source model used. For optimal performance, the LMX Series is recommended. Alternatively, the AFX or AZX Series may be used to support 787B3-0147 testing including DC power groups. Note that the 787 test software will allow acquisition of measurement data during the test execution but additional external test equipment is generally required as well to monitor EUT performance. The compliance matrix shown here applies to the stimulus requirement of the test standard only.

The table below summarizes the available test coverage for the test standard. For details, refer to the Boeing standard document.

AC Power	115Vac	235Vac	Notes
Individual Phase Voltage	Y	Y	
Average of Three Phase Voltages	Y	Y	No specified test
Phase Displacement	N/A	N/A	
Phase Voltage Unbalance	Y	Y	
Voltage Modulation	Y	Y	
Total Harmonic Content	Y	Y	Requires arbitrary waveform capability
Individual Harmonic Content	R	R	Not supported, requires additional equipment
DC Content	R	R	Requires AFX Series
Frequency Modulation	Y	Y	
Voltage Transients	Y	Y	
Voltage Spikes	R	R	Not supported, requires additional equipment
Maximum Ramp Rate	Y	Y	
Frequency Transients	Y	Y	
Multiple Stroke Power Interruptions	Y	Y	
Abnormal Individual Phase Voltage	Y	Y	
Abnormal Average of Three Phase Voltages	Y	Y	
Abnormal Voltage Transients	Y	Y	
Abnormal Maximum Ramp Rate	Y	Y	
Abnormal Frequency Transients	Y	Y	
Abnormal DC Content	N	N	Requires AFX or AZX Series
Supplementary Transient Tests	Y	Y	

Test No.	Description	I	II	III	IV	V	VI	Notes
3.3.3.1_B.5.1	Normal 28V DC Power Steady-State and Transient	Y						
3.3.3.1_B.5.2			Y					
3.3.3.1_B.5.3				Y				
3.3.3.1_B.5.4					Y			
3.3.3.1_B.6.1	Normal Voltage Transients	Y	Y	Y	Y			
3.3.3.1_B.6.2	Voltage Spikes							
3.3.3.1_B.6.3	Multiple Stroke Power Interrupts							
3.3.3.1_B.7.1	Abnormal Steady-State 28V DC Voltage	Y						
3.3.3.1_B.7.2			Y					
3.3.3.1_B.7.3				Y				
3.3.3.1_B.7.4					Y			
3.3.3.1_B.8.1	Abnormal Voltage Transients	Y	Y	Y	Y			
3.3.3.3_B.9.1.1	Engine Start					Y		These bipolar DC mode tests use 2 phases (A,B) in 3 Phase mode
3.3.3.3_B.9.1.2	Steady State					Y		
3.3.3.3_B.10.1	Normal Voltage Transients					Y		
3.3.3.4_B.11.1	Abnormal Steady State					Y		
3.3.3.4_B.12.1	Abnormal Voltage Transients					Y		These bipolar DC mode tests use 2 phases (A,B) in 3 Phase mode
3.3.3.5_B.13.1	Steady State						Y	
3.3.3.5_B.13.2	Common Mode Voltage						Y	
3.3.3.5_B.14.1	Normal Voltage Transients						Y	
3.3.3.6_B.16.1	Abnormal Voltage Transients						Y	

Notes: Y = Full support. No additional equipment is needed to perform the required AC stimulus  
 R = Requires additional equipment. Refer to actual Test Standard Documents for details.  
 N = Not supported

N/A = Not Applicable - No Test required  
 Z = Prog-Z required

DC: Type I, II, III & IV = 28Vdc. Type V =  $\pm 270$ Vdc, Type VI =  $\pm 130$ Vdc Nominal

## MIL-STD-704, Rev A and Rev F.

### Scope

MIL-STD-704 is published by the US Department of Defense and provides test requirements for both AC and DC power buses on military aircraft. Both fixed 400Hz and 60Hz frequency power buses as well as variable (wild) frequency power buses ranging from 360Hz to 800Hz are covered by Revision F of the standard. These tests are performed to ensure compliance of electrical equipment used on military airplanes. The MIL-STD-704A test option is available to support legacy avionics systems that were placed in operation under revision A. Both versions can be installed on the same PC.

The MIL-STD-704 standard covers both AC and DC power applications. The Pacific Power Source MIL-STD-704 A & F test options covers all AC power groups contained in the test standard as shown in the table below.

### Supported Power Groups

The following power groups are included in the MIL-STD-704F test option. MIL-STD-704A covers fixed frequency only.

Power Group	Description	Nominal Voltage	Nominal Frequency	Phase Modes
SAC	Single-Phase, 400 Hz Constant Frequency, 115 V	115Vrms L-N	400Hz	Single Phase
TAC	Three-Phase, 400 Hz Constant Frequency, 115 V	115Vrms L-N	400Hz	Three Phase
SVF	Single-Phase, Variable Frequency, 115 V	115Vrms L-N	360 – 800Hz	Single Phase
TVF	Three-Phase, Variable Constant Frequency, 115 V	115Vrms L-N	360 – 800Hz	Three Phase
SXF	Single-Phase, 60 Hz Constant Frequency, 115 V	115Vrms L-N	60Hz	Single Phase
LDC <sup>1</sup>	28VDC utilization equipment MIL-STD-704 compliance tests	28Vdc	n/a	n/a
HDC <sup>1</sup>	270VDC utilization equipment MIL-STD-704 compliance tests	270Vdc	n/a	n/a

Note 1: DC tests require AFX Series power source models.

### AC Power Test Execution Samples – MIL-STD-704

The following screens provide some typical captured output voltage waveforms from the AC Power Source during MIL-

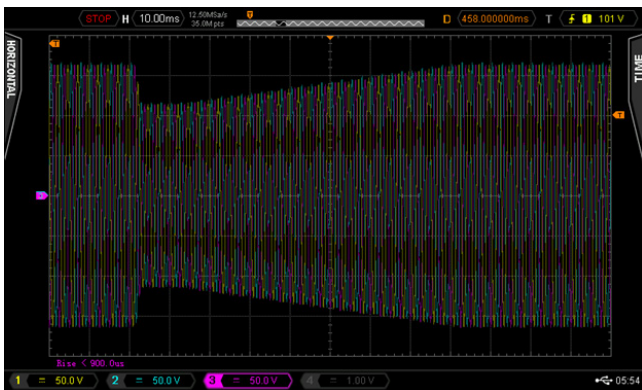


Figure 9: MIL-STD-704F, Power Group TAC, Section 109, Test Condition KK

STD-704 Test Sequence execution. Samples shown reflect two different test conditions from Table I, Figure 3 in the MIL-STD-704 document (Voltage Transients) see Figure 1 and a Momentary Power Interruption, see Figure 2.

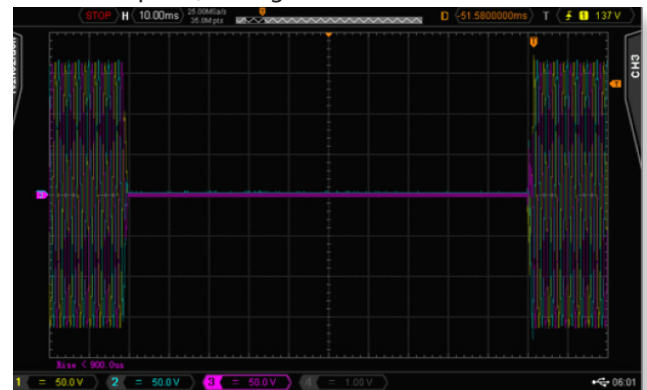


Figure 10: MIL-STD-704F, Power Group TAC, Section 601, Test Condition A

### DC Power Test Execution Samples – MIL-STD-704

The following screens provide some typical captured output voltage waveforms from the DC Power Source during MIL-

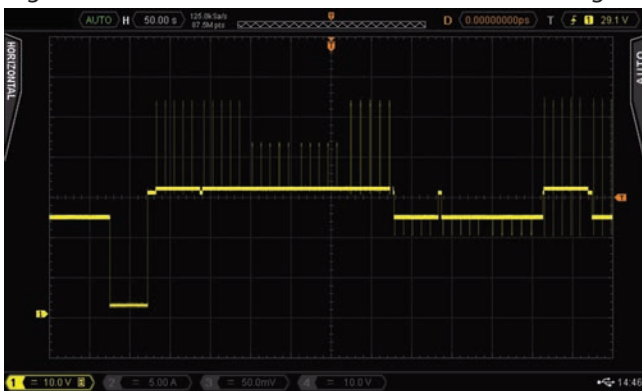


Figure 11: MS704F, LDC 105 sequence @ 50 S/div – Multiple Test Conditions

STD-704 Test Sequence execution. Samples shown reflect two different test conditions, LDC105 complete sequence (Figure 3) and HDC 201 detail view (Figure 4).



Figure 12: MIL-STD-704 Rev F, HDC 201 Cond K @ 10 mS/div – Detail

## Compliance Matrix MIL-STD-704F

Test	Description	SAC	TAC	SVF	TVF	SXF	Notes
Normal Operation (1xx)							
101	Load and Current Harmonics Measurements	Y	Y	Y	Y	Y	Additional Power Measurement Equipment recommended for capturing for UUT performance
102	Steady State Limits	Y	Y	Y	Y	Y	
103	Voltage Phase Difference	N/A	Y	N/A	Y	N/A	Not applicable for Single phase UUT's
104	Voltage Modulation	Y	Y	Y	Y	Y	
105	Frequency Modulation	Y	Y	Y	Y	Y	
106	Voltage Distortion Spectrum	M/R	M/R	M/R	M/R	M/R	Requires Function Generator, Spectrum Analyzer, 50uH inductors, 10uF Cap
107	Total Voltage Distortion	Y	Y	Y	Y	Y	
108	DC Voltage Component	Y	Y	Y	Y	Y	Requires AFX in AC+DC Mode
109	Normal Voltage Transients	Y	Y	Y	Y	Y	Requires Split Phase mode (FORM2) or Transformer (XFMR) for Single Phase, and Transformer(XFMR) for Three Phase UUT's
110	Normal Frequency Transients	Y	Y	Y	Y	Y	
Transfer (2xx)							
201	Power Interrupt	Y	Y	Y	Y	Y	Requires Split Phase mode (FORM2) or Transformer (XFMR) for Single Phase, and Transformer(XFMR) for Three Phase UUT's
Abnormal Operation (3xx)							
301	Abnormal Limits for Voltage and Frequency	Y	Y	Y	Y	Y	
302	Abnormal Voltage Transients	Y	Y	Y	Y	Y	Requires Split Phase mode (FORM2) or Transformer (XFMR) for Single Phase, and Transformer(XFMR) for Three Phase UUT's
303	Abnormal Frequency Transients	Y	Y	Y	Y	Y	
Emergency Operation (4xx)							
401	Emergency Limits for Voltage and Frequency	Y	Y	Y	Y	Y	
Starting (5xx)							
501	Not Typically Required	N/A	N/A	N/A	N/A	N/A	Not applicable to AC powered equipment
Power Failure (6xx)							
601	Power Failure	Y	Y	Y	Y	Y	
602	One Phase and Two Phase Power Failures	N/A	Y	N/A	Y	N/A	
603	Phase Reversal	Y	Y	Y	Y	Y	

DC Test <sup>1</sup>	Description	LDC	HDC	Notes	DC Test <sup>1</sup>	Description	LDC	HDC	Notes
Normal Operation (1xx)					Abnormal Operation (3xx)				
101	Load Test	Y	Y	Ext. Meas. Equipment	301	Abnormal Steady State Voltage	Y	Y	
102	Steady State Limits for voltage	Y	Y		302	Abnormal Voltage Transients	Y	Y	
103	Voltage Distortion Spectrum	R	R	Additional Equip. Req.	Emergency Operation (4xx)				
104	Total Ripple	M / R	M / R	AFX or ext. equipment	401	Transparency Time	Y	Y	
105	Normal Voltage Transients	Y	Y		Starting Operation (5xx)				
Transfer Operation (2xx)					501		Y	Y	
201	Power Interrupt	Y	Y		Power Failure Operation (6xx)				
Note1 : All DC tests require AFX Series					601	Power Failure	Y	Y	
					602	Polarity Reversal	Y	Y	Requires AFX in DC Mode

Notes: Y = Full support. No additional equipment is needed to perform the required AC stimulus  
R = Requires additional equipment. Refer to actual Test Standard Documents for details.  
N = Not supported

N/A = Not Applicable - No Test required  
M = Additional Measurement Equipment required  
Z = Prog-Z required



## MIL-STD-1399-300, Rev B. / MIL-STD-1399-300, Part 1

### Scope

MIL-STD-1399-300 is published by the US Department of Defense, Navy and provides test requirements for shipboard AC power. Both fixed 400Hz and 60Hz frequency power buses are covered by Revisions B and Part 1 of the standard. These tests are performed to ensure compliance of electrical equipment used on Navy vessels.

The MIL-STD-1399-300 standard covers AC power applications only. The Pacific Power Source MIL-STD-1399-300B test option covers all power groups contained in the test standard as shown in the table below.

### Supported Power Groups

The following power groups are included in both MIL-STD-1399-300 test options.

Type	Description	Nominal Vac	Frequency	Form
I	Single-Phase, 60 Hz, 115 V	115 Vrms	60Hz	Single Phase
	Single-Phase, 60 Hz, 440 V	440 Vrms	60Hz	Single Phase
	Single-Phase, Grounded, 60 Hz, 115 V (avionic shops)	115 Vrms	60Hz	Single Phase
	Three-Phase, 60 Hz, 115/200 V	115/200 Vrms	60Hz	Three Phase
	Three-Phase, 60 Hz, 254/440 V	254/440 Vrms	60Hz	Three Phase
	Three-Phase, Grounded, 60 Hz, 115/200 V (avionic shops)	115/200 Vrms	60Hz	Three Phase
II	Single-Phase, 400 Hz, 115 V	115V rms	400Hz	Single Phase
	Single-Phase, 400 Hz, 440 V	440 Vrms	400Hz	Single Phase
	Three-Phase, 400 Hz, 115 /200V	115/200 Vrms	400Hz	Three Phase
	Three-Phase, 400 Hz, 254/440 V	254/440 Vrms	400Hz	Three Phase
III	Single-Phase, 400 Hz, 115 V	115 Vrms	400Hz	Single Phase
	Single-Phase, 400 Hz, 440 V	440 Vrms	400Hz	Single Phase
	Single-Phase, Grounded, 400 Hz, 115 V (avionics shops/service)	115 Vrms	400Hz	Single Phase
	Three-Phase, 400 Hz, 115/200 V	115/200 Vrms	400Hz	Three Phase
	Three-Phase, 400 Hz, 254/440 V	254/440 Vrms	400Hz	Three Phase
	Three-Phase, Grounded, 400 Hz, 115/200 V (avionics shops/service)	115/200 Vrms	400Hz	Three Phase

### Test Execution Sample – MIL-STD-1399-300B

The following screens provides a typical captured output voltage waveforms from the AC Power Source during MIL-STD-1399 Test Sequence execution.

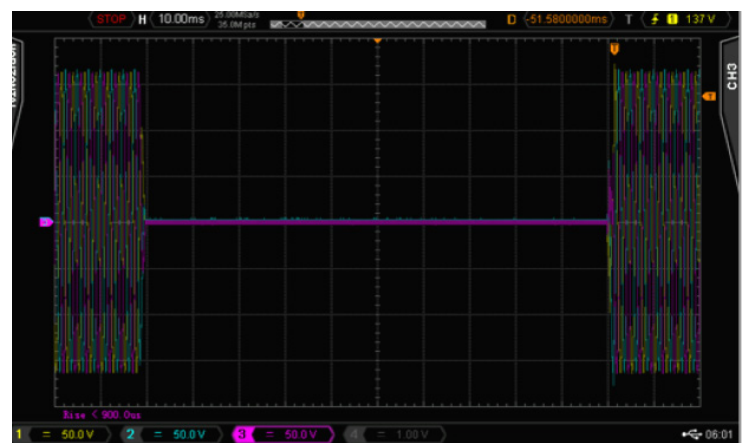


Figure 13: MIL-STD-1399-300 Rev B, Type I, Section 5.3.2.2



## Compliance Matrix MIL-STD-1399-300, Rev B

MIL-STD-1399 SECTION No.	Test Description	Test Category		
		Type I	Type II	Type III
5.3.1.2	Voltage and frequency tolerance test	T	T	T
5.3.2.2	Voltage and frequency transient tolerance and recovery test	T	T	T
5.3.3	Voltage spike test	R	R	R
5.3.4.2.1	Emergency condition test - 70 msec power interruption test	T	T	T
5.3.4.2.2	Emergency condition test - 2-Minute power interruption test	T	T	T
5.3.4.2.3	Emergency condition test - Power source decay test	T	T	T
5.3.4.2.4	Emergency condition test - Positive excursion test	T	T	T
5.3.5.2	Grounding test	T	T	T
5.3.6	User equipment power profile test	R	R	R
5.3.7	Current waveform test	R	R	R
5.3.8.2a	Voltage and frequency modulation test - Voltage modulation test	T	T	T
5.3.8.2b	Voltage and frequency modulation test - Frequency modulation test	T	T	T
5.3.8.2c	Voltage and frequency modulation test - Combined voltage and frequency modulation test	T	T	T
5.3.9.2	Simulated human body leakage current tests for personnel safety	T	T	T

## Compliance Matrix MIL-STD-1399-300, Part 1

MIL-STD-1399 SECTION No.	Test Description	Test Category		
		Type I	Type II	Type III
5.3.1.2	Grounding susceptibility test	T	T	T
5.3.2	User equipment power profile test	N	N	N
5.3.3.2	Voltage and frequency maximum departure tolerance test	T	T	T
5.3.4.2	Voltage and frequency transient tolerance and recovery test	T	T	T
5.3.5	Voltage spike test	N	N	N
5.3.6.2.1	Emergency condition test - 70 msec power interruption test	T	T	T
5.3.6.2.2	Emergency condition test - 2-Minute power interruption test	T	T	T
5.3.6.2.3	Emergency condition test - Power source decay test	T	T	T
5.3.6.2.4	Emergency condition test - Positive excursion test	T	T	T
5.3.7	Current waveform test	N	N	N
5.3.8.2a	Voltage and frequency modulation test - Voltage	T	T	T
5.3.8.2b	Voltage and frequency modulation test - Frequency	T	T	T
5.3.8.2c	Voltage and frequency modulation test - Combined	T	T	T
5.3.9.2	Simulated human body leakage current tests for personnel safety	T	T	T

Notes: Y = Full support. No additional equipment is needed to perform the required AC stimulus  
 R = Requires additional equipment. Refer to actual Test Standard Documents for details.  
 N = Not supported

N/A = Not Applicable - No Test required

Z = Prog-Z required

T = This test may require a Transformer Option for high nominal voltage test groups to support higher voltages depending on AC Source model used.

## RTCA/DO-160, Section 16, Rev G.

### Scope

The Radio Technical Commission for Aeronautics (RTCA) is an industry organization that publishes the DO-160 Commercial Avionics Test standard which covers Environmental Conditions and Test Procedures for Airborne Equipment. These tests are performed to ensure compliance of electrical equipment used on commercial airplanes.

### Supported Power Groups

The following power groups are included in the RTCA/DO-160 test option. DC Power Tests are only supported on AFX Series.

Power Group	Description	Nominal Voltage	Nominal Frequency	Phase Modes
ACF	AC Power, Constant Frequency	115Vrms L-N	400Hz	1 Phase and 3 Phase
		230Vrms L-N		
ANF	AC Power, Narrow Variable Frequency	115Vrms L-N	360 – 800Hz	
		230Vrms L-N		
AWF	AC Power , Wide Variable Frequency	115Vrms L-N	360 – 800Hz	
		230Vrms L-N		
Cat.A, 28dc	DC Power Test	28 Vdc	n/a	n/a
Cat B, 14Vdc	DC Power Test	14 Vdc	n/a	n/a
Cat B, 28Vdc	DC Power Test	28 Vdc	n/a	n/a
Cat Z, 28Vdc	DC Power Test	28 Vdc	n/a	n/a
Cat D, 270Vdc	DC Power Test	270 Vdc	n/a	n/a

### AC Power Test Execution Samples – DO160

The following screens provide some typical captured output voltage waveforms from the AC Power Source during RTCA/DO-



Figure 14: DO-160G Section 16.5.1.4 b Test Condition 7

160 Test Sequence execution. Samples shown reflect two different test conditions from Section 16.5.1.4, Momentary Power Interruptions.

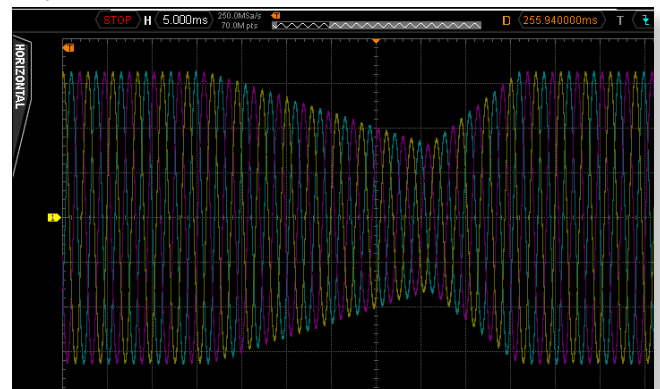


Figure 15: DO-160G Section 16.5.1.4 b-Test Condition 9

### DC Power Test Execution Samples – DO160

The following screens provide some typical captured output voltage waveforms from the DC Power Source during DO160

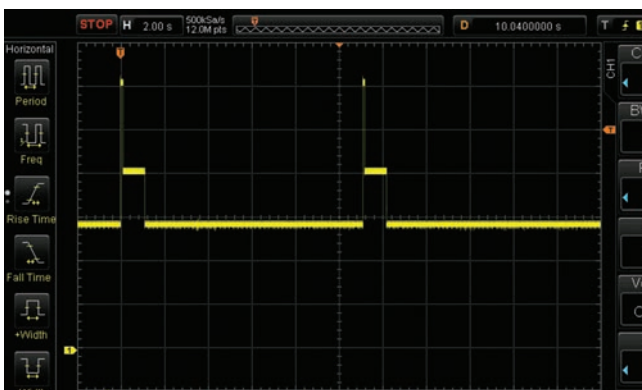


Figure 16: DO160G\_AFX\_16.6.2.4d\_catB\_28V\_Abnormal\_Surges

Test Sequence execution. Samples shown reflect two different test conditions, 16.6.2.4d Cat B, 28Vdc (Figure 16) and 16.6.1.4c Cat D, 270Vdc (Figure 17).



Figure 17: DO160G\_AFX\_16.6.1.4c\_catZ\_270V\_Normal\_Surge

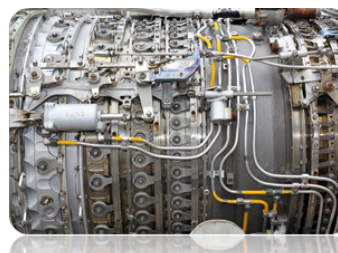
## Compliance Matrix RTCA/DO-160

Phases	Section	Description	ACF	ANF	AWF	Notes
Single Phase	16.5.1.1.b1	Normal Voltage & Frequency	Y	Y	Y	
	16.5.1.2	Normal Voltage Modulation	Y	Y	Y	
	16.5.1.3	Normal Frequency Modulation	Y	Y	Y	
	16.5.1.4.b	Normal Momentary Power Interruptions - Test 1	Y	Y	Y	
	16.5.1.4.c	Normal Momentary Power Interruptions - Test 2	Y	Y	Y	
	16.5.1.5.1.b	Normal Surge Voltage	Y	Y	Y	High voltage spikes up to 160VAC or 320VAC, requires Split Phase mode (FORM2) or Transformer (XFMR)
	16.5.1.6.b	Normal Frequency Variations	Y	Y	Y	
	16.5.1.7	Normal Voltage DC Content	Y / R	Y / R	Y / R	Requires AFX Series
	16.5.1.8.2	Normal Total Harmonic Distortion	Y	Y	Y	Specification allows either clipped waveform or full-wave bridge rectifier load
	16.5.2.1.b	Abnormal Volt/Freq Limit Steady State	Y	Y	Y	
	16.5.2.2	Momentary Undervoltage Operation	Y	Y	Y	
	16.5.2.3.1	Abnormal Surge Voltage	Y	Y	Y	High voltage spikes up to 180VAC or 360VAC, requires Split Phase mode (FORM2) or Transformer (XFMR)
	16.5.2.3.2	Abnormal Frequency Transients	Y	Y	Y	
Three Phase	16.5.1.1.c	Normal Voltage & Frequency	Y	Y	Y	
	16.5.1.1.ce	Emergency Voltage & Frequency	Y	Y	Y	
	16.5.1.2	Normal Voltage Modulation	Y	Y	Y	
	16.5.1.3	Normal Frequency Modulation	Y	Y	Y	
	16.5.1.4.b	Normal Momentary Power Interruptions - Test 1	Y	Y	Y	
	16.5.1.4.c	Normal Momentary Power Interruptions - Test 2	Y	Y	Y	
	16.5.1.5.1.b	Normal Surge Voltage	Y	Y	Y	High voltage spikes up to 160VAC or 320VAC, requires Transformer(XFMR)
	16.5.1.5.2.b	Normal Frequency Transients	Y	Y	Y	
	16.5.1.6.b	Normal Frequency Variations	Y	Y	Y	
	16.5.1.7	Normal Voltage DC Content	Y / R	Y / R	Y / R	Requires AFX Series
	16.5.1.8.2	Normal Total Harmonic Distortion	Y	Y	Y	Specification allows either clipped waveform or full-wave bridge rectifier load
	16.5.2.1.c	Abnormal Volt/Freq Limit Steady State	Y	Y	Y	
	16.5.2.2	Momentary Undervoltage Operation	Y	Y	Y	
	16.5.2.3.1	Abnormal Surge Voltage	Y	Y	Y	High voltage spikes up to 180VAC or 360VAC, requires "Transformer Coupled" AC Source capability
	16.5.2.3.2	Abnormal Frequency Transients	Y	Y	Y	
	16.5.2.3.3	LAbsnormal Frequency Variations	N/A	Y	Y	
	16.5.2.4.ab	Loss Of Phase Input	N/A	Y	Y	
	16.5.2.4.cd	Loss Of Phase Input	N/A	Y	Y	

DC Test	Description	B.14V	A.28V	B.28V	Z.28V	D.270V	Notes - All DC tests require AFX Series
16.6.1.1 - .4	Normal Voltage, Ripple, Interrupts, Surge	Y	Y	Y	Y	Y	
16.6.1.2	Ripple	R	R	R	R	R	
16.6.1.5	Engine Starting Under Voltage	Y	N/A	Y	Y	N/A	
16.6.1.6	Exposed Voltage Decay Time	N/A	N/A	N/A	N/A	Y	Test is not supported
16.6.2.1	Voltage Steady State	Y	Y	Y	Y	Y	
16.6.2.2	Low Voltage Conditions	Y	N/A	Y	N/A	N/A	
16.6.2.3	Momentary Under Voltage	Y	Y	Y	Y	Y	
16.6.2.4	Abnormal Surge Voltage	Y	Y	Y	Y	Y	

Notes: Y = Full support. No additional equipment is needed to perform the required AC stimulus  
R = Requires additional equipment. Refer to actual Test Standard Documents for details.  
N = Not supported

N/A = Not Applicable - No Test required  
Z = Prog-Z required

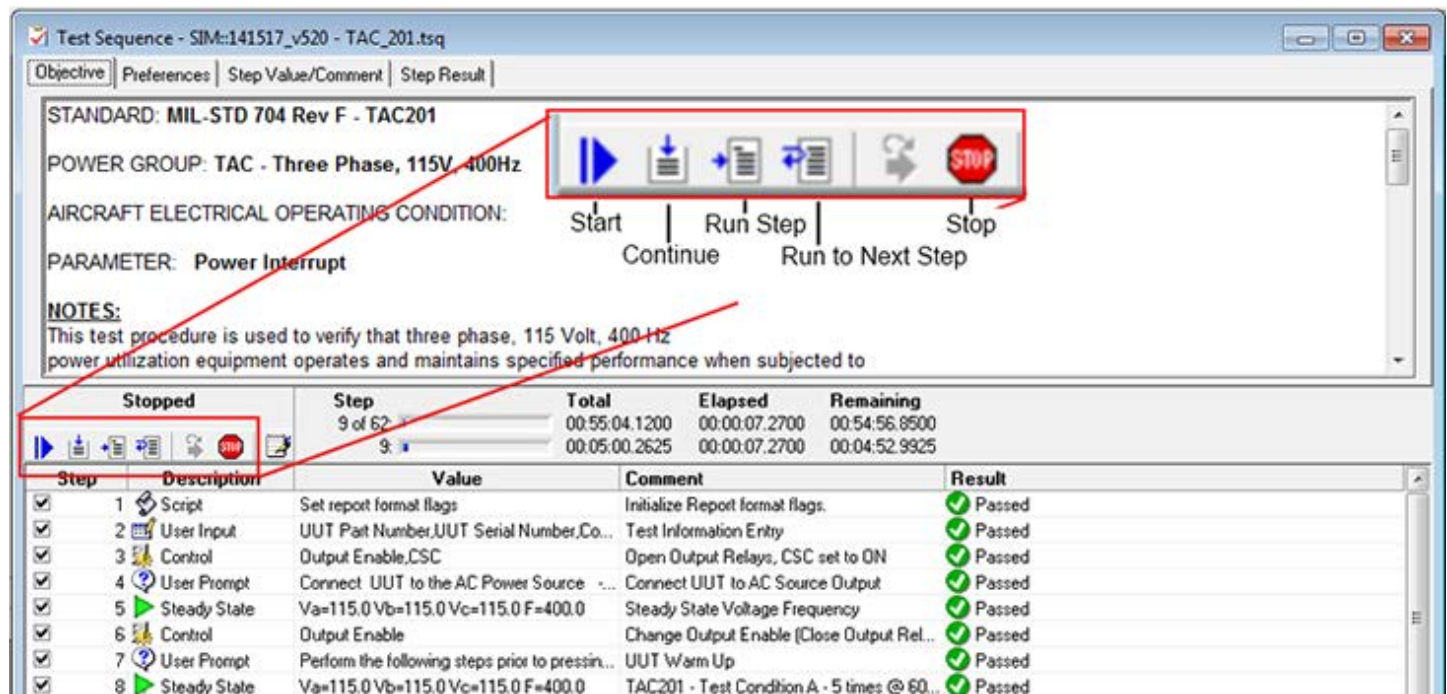


## Common Features

Since all available avionics test options are integrated into the UPC Studio Test Manager, they share a common set of features and capabilities which makes it easy for the operator to perform these tests. It also ensures consistency of user interface and operation when moving between different test standards.

## Test Execution Control

The operator has complete control over Test Sequence execution by running the entire Test Sequence or single stepping through one test condition at a time. This allows for any anomaly observed on the UUT to be analyzed in more detail by stepping or looping on an individual stimulus test condition. If needed, specific test conditions can be skipped by deselecting the Step selection check box that precedes each step in the Test Sequences. This allows selective execution of test conditions in a Test Sequence to be setup.



The screenshot shows the 'Test Sequence - SIM:141517\_v520 - TAC\_201.tsq' window. The 'Objective' tab is selected, showing the test standard (MIL-STD 704 Rev F - TAC201), power group (TAC - Three Phase, 115V, 400Hz), aircraft electrical operating condition, and parameter (Power Interrupt). A set of execution controls is highlighted with a red box: Start (blue play button), Continue (blue document with arrow), Run Step (blue document with magnifying glass), Run to Next Step (blue document with double arrow), and Stop (red stop button). Below the controls, a table shows the test sequence steps, with the first step (Script) highlighted. The table has columns for Step, Description, Value, Comment, and Result.

Step	Description	Value	Comment	Result
1	Script	Set report format flags	Initialize Report format flags.	Passed
2	User Input	UUT Part Number,UUT Serial Number,Co...	Test Information Entry	Passed
3	Control	Output Enable,CSC	Open Output Relays, CSC set to ON	Passed
4	User Prompt	Connect UUT to the AC Power Source - ...	Connect UUT to AC Source Output	Passed
5	Steady State	Va=115.0 Vb=115.0 Vc=115.0 F=400.0	Steady State Voltage Frequency	Passed
6	Control	Output Enable	Change Output Enable (Close Output Rel...	Passed
7	User Prompt	Perform the following steps prior to pressin...	UUT Warm Up	Passed
8	Steady State	Va=115.0 Vb=115.0 Vc=115.0 F=400.0	TAC201 - Test Condition A - 5 times @ 60...	Passed

A set of execution controls is located above the Test Sequence listing in the UPC Test Manager window. Available options are Start, Continue, Run Step, Run to Next Step (Single step mode) and Stop.

## Customization of Test Routines

All Test Sequence files are provided from the factory to comply with the relevant test standard requirements. Test files can be password protected using a password so they cannot be edited by unauthorized personnel. Any changes made to the Test Sequence files will result with a automated incremental revision number. Modified Test Sequences may be used to support future revision changes to the standard or to provide additional AC or DC power stimulus beyond the standard requirements.

If modification or changes are needed, it is recommended to save the original files provided as a restore point or retain the original distribution setup file so the original version of the Test Sequences can be restored at any time.

## Comprehensive Test Reports

Properly documenting the power sequences applied to the unit under test is a key requirement for vendors to prove compliance with relevant Avionics test standards. This involves detailed documentation on AC power stimulus, conditions and EUT performance as evidenced by voltage, current and power measurements.

The Pacific Power Source's Avionics test options provide built-in report generation using a universal Rich Text Format (RTF) report file which can be printed or converted to several other formats such as PDF and HTML.

Test reports include details for each power group on the nature and duration of power stimulus patterns, measured data and any comments and test results entered by the operator during the test based on his observations of the Equipment under test. A report template is used to format these reports and the user has the ability to customize these reports by adding company logo's and names to the provided report templates.

At any time during the execution of the Test Sequence, the test report that is being generated can be pre-viewed on screen by clicking on the "Show Test Report" button in the test window. At the end of the test, the report is saved and the operator is provided with the opportunity to assign a specific report file name.

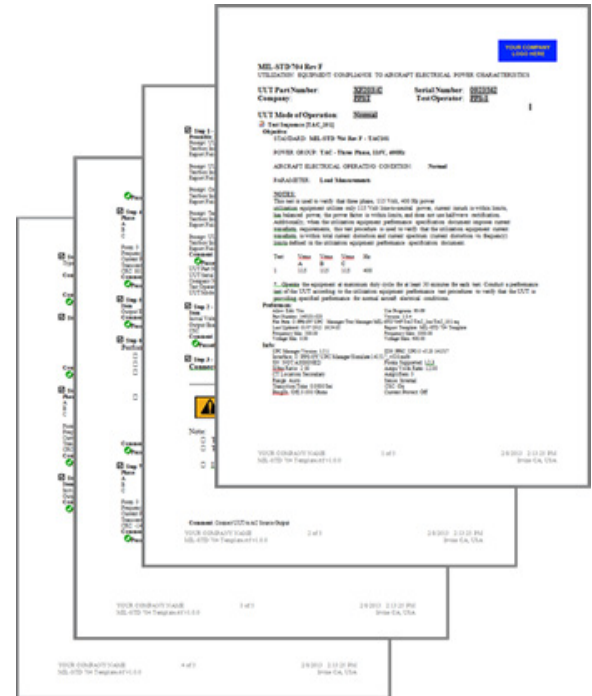


Figure 18: Sample Test Report

## IEC Compliance Test System

If your requirements include compliance testing of commercial or industrial products, Pacific Power Source also offers complete Harmonics and Flicker Test Systems including IEC 61000-4 Immunity Test Sequences.

Refer to our [ECTS2 Series](#) and [EMC Compliance Test Option](#) data sheet available online for more information.

IEC Standard	Category	Description	Supported Version	Edition	Dated
IEC 61000-3-2	Emissions	Limits for harmonic current emissions (equipment input current $\leq 16$ A per phase)	IEC 61000-3-2:2018+AMD1:2020 CSV	5.1	2020-07-14
IEC 61000-3-3	Emissions	Limitation of voltage changes, voltage fluctuations and flicker $\leq 16$ A per phase	IEC 61000-3-3:2013/AMD2:2021	3.2	2021-07-14
IEC 61000-3-11	Emissions	Limitation of voltage changes, voltage fluctuations and flicker $\leq 75$ A and subject to conditional connection	IEC 61000-3-11:2017 RLV	2.0	2017-04-21
IEC 61000-3-12	Emissions	Limits for harmonic currents produced by equipment connected to public low-voltage systems $>16$ A and $\leq 75$ A per phase	IEC 61000-3-12:2011	2.1	2021-06-04
IEC 61000-4-7	Reference	Testing and measurement techniques - General guide on harmonics and interharmonics measurements and instrumentation	IEC 61000-4-7:2002+AMD1:2008 CSV	2.1	2009-10-28
IEC 61000-4-15	Reference	Testing and measurement techniques - Flicker meter - Functional and design specifications	IEC 61000-4-15:2010 RLV	2.0	2010-08-24
IEC 60725	Reference	Reference impedances and public supply network impedances $\leq 75$ A per phase	IEC TR 60725:2012	3.0	2012-06-27
IEC 61000-4-11	Immunity	Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	IEC 61000-4-11:2020	3.0	2020-05-28
IEC 61000-4-13	Immunity	Harmonics and interharmonics including mains signaling at a.c. power port, low frequency immunity tests	IEC 61000-4-13:2002+AMD1:2009+A MD2:2015 CSV	1.2	2015-12-14
IEC 61000-4-14	Immunity	Voltage fluctuation immunity test for equipment with input current not exceeding 16 A per phase	IEC 61000-4-14:1999+AMD1:2001+A MD2:2009 CSV	1.2	2009-08-12
IEC 61000-4-17	Immunity	Ripple on DC input power port immunity test	IEC 61000-4-17:1999+AMD1:2001+A MD2:2008 CSV	1.2	2009-01-28
IEC 61000-4-27	Immunity	Unbalance, immunity test for equipment with input current not exceeding 16 A per phase	IEC 61000-4-27:2000+AMD1:2009 CSV	1.1	2009-04-07
IEC 61000-4-28	Immunity	Variation of power frequency, immunity test for equipment with input current not exceeding 16 A per phase	IEC 61000-4-28:1999+AMD1:2001+A MD2:2009 CSV	1.2	2009-04-07
IEC 61000-4-29	Immunity	Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests	IEC 61000-4-29:2000	1.0	2000-08-30
IEC 61000-4-34	Immunity	Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase	IEC 61000-4-34:2005+AMD1:2009 CSV	1.1	2009-11-26
IEC TR 61000-4-37	Calibration	Calibration and verification protocol for harmonic emission compliance test systems	IEC TR 61000-4-37:2016	1.0	2016-01-07
IEC TR 61000-4-38	Calibration	Test, verification and calibration protocol for voltage fluctuation and flicker compliance test systems	IEC TR 61000-4-38:2015	1.0	2015-08-24

IEC Standards and Editions supported by ECTS2 Series EMC Test Systems



**EMC COMPLIANCE TEST SYSTEMS**  
ECTS2 SERIES

**INTEGRATED TEST SYSTEMS**  
Key features ECTS2 Systems:

- Available Emissions Tests:
  - IEC 61000-3-2 Harmonics Emissions
  - IEC 61000-3-3 Flicker Emissions
  - IEC 61000-3-11 Flicker Emissions
- Available Immunity Test Software:
  - IEC 61000-4-11 (Option)
  - IEC 61000-4-13 (Option)
  - IEC 61000-4-14
  - IEC 61000-4-17
  - IEC 61000-4-27
  - IEC 61000-4-28
  - IEC 61000-4-29 (Option)
  - IEC 61000-4-34 (Option)
- Available Auxiliary Test Software:
  - RTCA DO160, Section 16
  - MIL-STD-704
  - Arbus AR01100.1.8 (A/R)
  - Arbus AR01100.1.8.1 (A/R)
  - Arbus AR02100.1.8 (A/R)
  - Boeing 787-9-017

**Overview**  
Pacific Power Source EMC Compliance Test Systems use a greatly enhanced harmonics and flicker measurement system and newly designed flicker impedance options to support single and three phase AC harmonics, flicker and immunity compliance testing up to the maximum required current of 75A per phase.

The measurement system uses a USB interface to the user's laptop or desktop eliminating the need for an integrated PC, monitor and keyboard connected to power generation Harmonics and Flicker test systems.

AC power to the unit under test is still supplied by a Pacific Power Source LMS Series high performance linear power source for systems up to 150A/phase. For higher power systems up to 75A/phase the compact and efficient APT Series switch mode power source is used. The AC power output of these units easily exceeds the IEC 61000-3 standard requirements for the AC source.

All tests are computer controlled to eliminate operator errors and ensure consistent applications of the required test in full compliance with the IEC standards. Data is collected by the PC, time for signal logging and a comprehensive test report is generated at the end of the test. The windows based software uses intuitive graphical control elements to select the correct test mode and displays data in real time, while the test is in progress.



**IEC Immunity Option**      **IEC 61000-4 AC Immunity Test Routines**

**Available Features:**  
Available Compliance Test Sequences for the following IEC 61000-4 Conducted Immunity Test Standards:

- IEC 61000-4-11 Voltage dips, short interruptions and voltage fluctuations immunity test for equipment with mains current less than 16 A per phase
- IEC 61000-4-13 Harmonics and interharmonics including mains signaling at AC power port, low frequency immunity tests
- IEC 61000-4-14 Voltage fluctuation immunity test
- IEC 61000-4-17 Ripple on DC input power port immunity test (APR Test only)
- IEC 61000-4-20 Unbalance, immunity test for equipment with input current not exceeding 16 A per phase
- IEC 61000-4-27 Variation of power frequency, immunity test for equipment with input current not exceeding 16 A per phase
- IEC 61000-4-28 Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests
- IEC 61000-4-34 Voltage dips, short interruptions and voltage variations immunity test for equipment with mains current more than 16 A per phase

**Common Features for all IEC 61000-4 Test Sequences Provided:**

- Real-time test sequences and test levels conform to IEC 61000-4 standards, only to be used for reference. No need for reprogramming the hardware or user interface.
- Immunity tests can be run continuously or in single step mode to allow observation of test results. Any improvement needed (design changes).
- Measurement data is logged and stored and recorded at each test step and included in test reports.
- Use of the test system is simple and easy to use and requires no special training or other facilities.
- The test system is designed to be used in a laboratory or field environment.
- Reports are generated in HTML format for compatibility with most web browsers.
- All test sequences are fully customizable by user if needed to create custom test or special purpose test sequences as desired. Accommodating IEC standards if needed. Test sequences can be stored and used as a permanent feature of the system.

**IEC International Electrotechnical Commission**

**IEC Immunity Testing**  
The EMC Directive is one of the "New Approach" Directives and applies across all 27 member states of the European Union (EU). The Directive applies to all electronic or electrical products liable to cause or be disturbed by electromagnetic interference (EMI). As a result a large number of manufacturers in the electronics or electrical industries need to ensure that their products are compliant with the requirements of the Directive and be able to demonstrate that this is the case in order to affix the CE Mark.

To verify compliance with these directives, the International Electrotechnical Commission (http://www.iec.ch) has issued a number of harmonized standards that describe the test methods, test levels and test or fail criteria. A number of these test standards cover immunity to commonly found AC line anomalies that are known to occur on the public Low Voltage (LV) network. These conducted immunity standards are numbered IEC 61000-4 series. These IEC 61000-4 standards are not product specific, but rather generic and may be applied to numerous product categories to ensure compliance with CE mark requirements.

There are additional product specific IEC standards that cover individual product types. To determine the IEC 61000-4 tests that apply to a particular product category, refer to the relevant product standards. For example, the IEC EMC product standard that applies to programmable AC power sources is IEC 61326-1, "Electrical equipment for measurement, control and laboratory use - EMC requirements". It calls out which IEC 61000-4 tests must be performed, what product class is applicable and any specific set of test levels and pass/fail criteria. Consult the product specific EMC Immunity standard for the product you intend to test. Copies of these standards can be purchased at the IEC web site (<http://www.iec.ch>).

All standards included in Pacific Power Source's IEC Test option package relate to AC conducted immunity testing for IEC 61000-4-29 which is a DC test.

**PACIFIC POWER SOURCE**  
THE POWER OF EXPERTISE

## Recommended AC Source Models

All Pacific Power Source products with programmable controllers support Avionics test options covered by this data sheet. This includes AFX, LMX, ASX and AZX Series. The best performance AC Source models for these tests are the Linear Technology LMX Series, available in power levels of 500VA to 30kVA. The high bandwidth of the linear amplifiers provides optimum harmonics generation and high frequency small signal support for modulation and distortion generation tests.

The AFX and AZX Series offer an economical alternative if avionics testing is not the only or primary application or if DC testing and AC+DC Tests are required. For high power applications, the AFX or AZX Series offer the best alternatives.

The optimal AC Power Source model and configuration will depend largely on your specific avionics test requirements. Factors to consider are required maximum test voltage, UUT power requirements and phase modes.

## Test Voltage Requirements

Test labs that may have to test for all standards and all possible nominal voltage values should consider using three phase mode AC Power Source with a suitable output transformer option to provide maximum coverage. A 3.0:1 transformer ratio will support the 360Vrms that is required for some of the transient tests in ABD, and DO160. If most testing is done at 115V-L-N nominal output voltage, a 1.5:1 Transformer option or AFX Series unit will provide optimal output power.

## Programmable Impedance

For optimal performance, Prog-Z is recommended for all avionic test options.

## Output Power Requirements

It is important not to undersize the AC Power Source for these types of tests. Several tests require to addition of a load in parallel to the UUT which increases the required power output of the AC Power Source beyond the rating of the UUT. Also consult the voltage versus current de-rating charts of the power source model to verify it provides adequate current at the required test voltages, including abnormal and emergency voltage levels.

## Phase Mode

A power source with three phase output mode capability is often required for avionics testing as many of the UUT's found in avionics require three phase input. This helps reduce the per phase current compared to a single phase AC input UUT which is especially important at higher UUT power levels. A three phase AC Power Source can be used in single phase mode as well which covers all UUT types. If only single phase UUT's are ever tested, a single phase model may suffice.

## Frequency Range

All Pacific Power Source's AFX, ASX and LMX Series power sources provide output frequency operation up to 1200Hz or higher to support both 400Hz fixed and 360-800Hz variable frequency avionics testing.

In view of the wide range of configurations and options available in Pacific Power Source Inc's product line, we recommend you contact one of our applications engineers to discuss your requirements and determine the most cost effective solution for your avionics testing needs.



LMX Series



ASX-Series



AFX-Series



AZX-Series

## Ordering Information

OPTIONS	REVISION	P/N	DESCRIPTION
<input type="checkbox"/> ABD0100.1.8E (A380)	E	149102	Airbus ABD0100.1.8, Rev E, Test Sequences
<input type="checkbox"/> ABD0100.1.8.1C (A350)	C	149125	Airbus ABD0100.1.8.1, Rev C, Test Sequences
<input type="checkbox"/> AMD24C (A400M)	C	149127	Airbus AMD24C, Rev C, Test Sequences
<input type="checkbox"/> Boeing 787B3-0147 (787)	C	149126	Boeing 787B3-0147 (787), Rev C, Test Sequences
<input type="checkbox"/> MIL-STD-704A	A	149112	DoD MIL-STD-704, Rev A, Test Sequences
<input type="checkbox"/> MIL-STD-704F	F	149101	DoD MIL-STD-704, Rev F, Test Sequences
<input type="checkbox"/> MIL-STD-1399-300B	B	149130	DoD MIL-STD-1399, Rev B, Test Sequences
<input type="checkbox"/> MIL-STD-1399-300 Part 1	1	149132	DoD MIL-STD-1399, Part 1, Test Sequences
<input type="checkbox"/> DO-160G	G	149124	RTCA/DO-160, Section 16, Rev G, Test Sequences

## Order Example

- RTCA/DO-160G
- UPC Test Manager License
  - Licenses for RTCA/DO-160 Rev G Test Sequence and UPC Test Manager

## Typical Delivery Items

- Test Sequence Files FTP Download
- User Documentation in PDF Format

## Support on Models

- LMX Series (AC Tests only)
- ASX Series (AC Tests only)
- AFX Series (AC, DC and AC+DC Test)
- AZX Series Regenerative (AC, DC and AC+DC Test)

## The Leader in AC Power Technology

An early pioneer in the development solid-state power conversion equipment, Pacific Power Source continues to develop, manufacture, and market both linear and high-performance PWM AC Power Sources. Pacific Power's reputation as a market and technology leader is best demonstrated by its continuing investments in both research and development and world-wide customer support. With corporate owned offices in the United States, Germany, the United Kingdom, and China, local personalized support is always available.



ECTS2 Series EMC Test Systems 45kVA AC+DC



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